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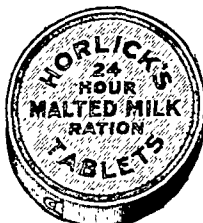
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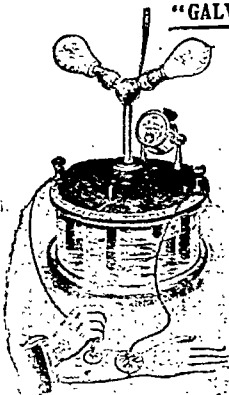
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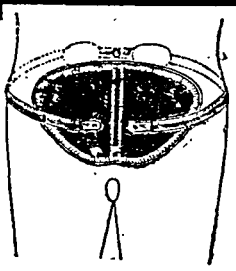
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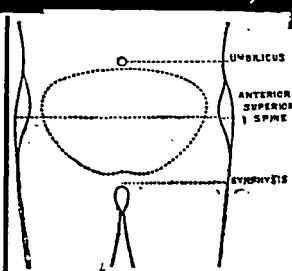
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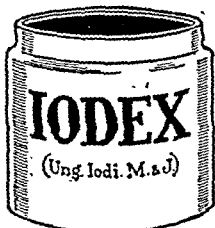
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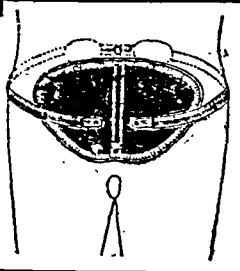
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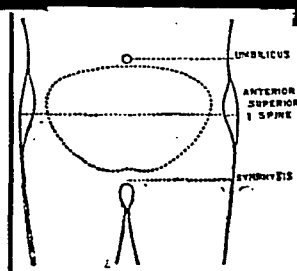
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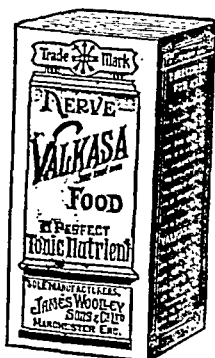
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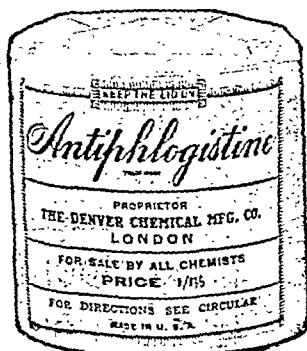
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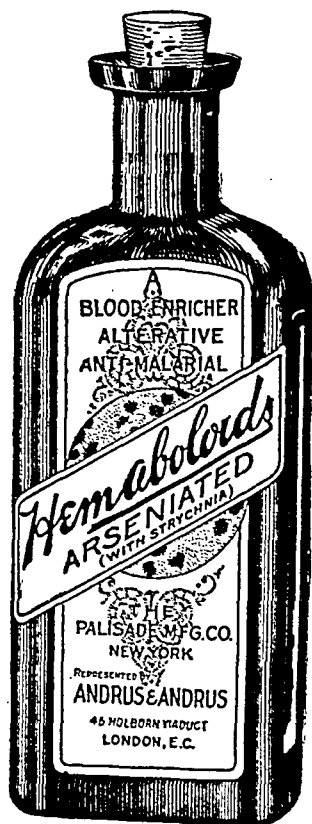
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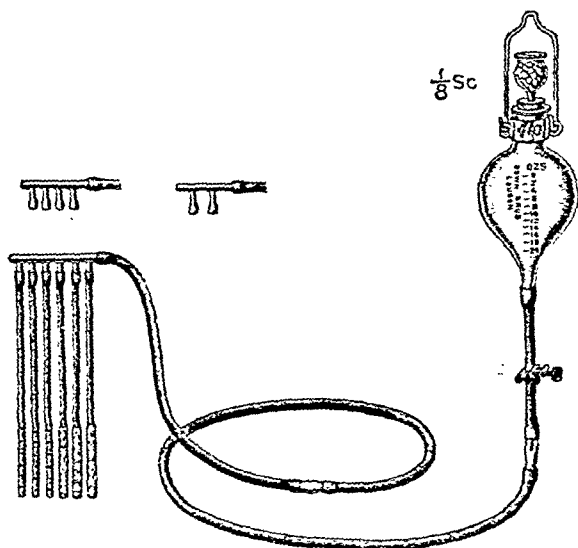
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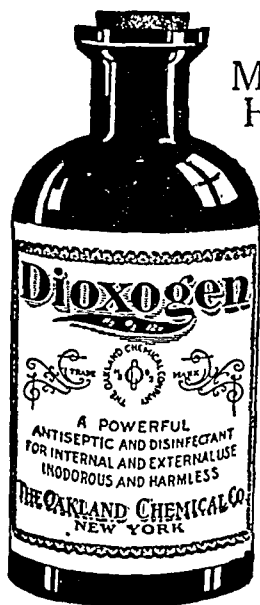
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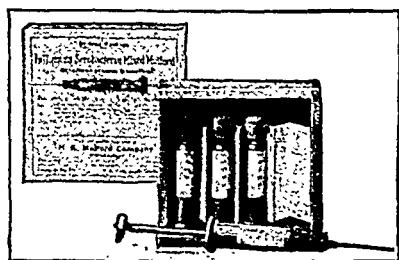
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Staphylococcus aureus	125	250	500	1000 million
Streptococcus	125	250	500	1000 million
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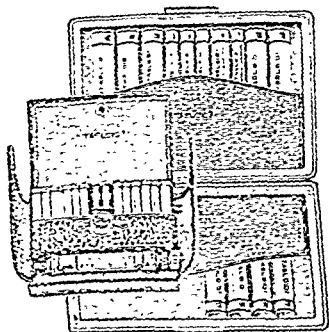


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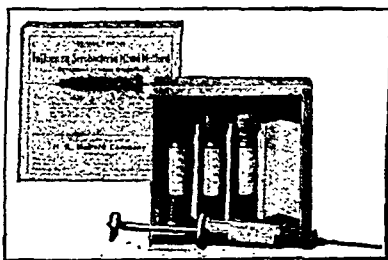
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32.—Vol. XCVII., No. 6. PRACTITIONER.

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DECEMBER, 1916.

VENEREAL DISEASES AS WE SEE THEM TO-DAY.

By J. E. R. McDONAGH, F.R.C.S.

Surgeon to the London Lock Hospital, etc.

ENGLISH AND AUSTRALIAN REPORTS.

EARLY this year the Final Report of the Royal Commission on Venereal Diseases appeared. Later in the year, there came to hand the Report on Venereal Diseases by a Committee of the Department of Trade and Customs of the Commonwealth of Australia. This latter document is important, because it shows how much can be done when the matter is relegated to a few men, who have a fixed object in view. Four men sign the Australian document, three of whom are doctors. The measures proposed are thorough, and show up sharply the compromise which pervades our own report. One of the most striking differences in the two reports is that which relates to the quack. Our Local Government Board, which proposes to put the suggestions made by the Commission into practice—suggestions which have, since their promulgation, been modified and amplified—has practically ignored the treatment of the quack, for his name does not appear in the summary of recommendations. For instance, we find the following statement (page 54):—

"We should have advocated legal provisions, making the treatment of venereal disease by unqualified persons a penal offence, but we recognize the practical difficulties in securing the effective operation of such a law in present circumstances."

The following is what the Australian document has to say on the subject:—

"That it be *unlawful* for any person other than a legally qualified medical practitioner to treat any case of venereal disease, etc."

"That all advertisements or published statements be prohibited

concerning any remedy for venereal diseases or for any disease or weakness of the generative organs, including female or menstrual disorders, or concerning any special claim to skill in treating such diseases, etc."

After all, what is the good of a Commission, if it cannot see its way to devise a means for overcoming a difficulty, which it seriously recognizes should be overcome? If the Commonwealth can propose that treatment by a quack should be made illegal, surely we can do so too. The Commonwealth report is unpretentious, of only 18 pages, and firm about the measures proposed. Our report is more or less a text-book of 191 pages, and the measures proposed are vacillating in nature. Summing up the former, we find that notification and treatment by specialists is the essence of the scheme, and that further research should be encouraged into questions concerning venereal disease; it is even suggested that the life history of the parasite of syphilis should be enquired into.

Our own document is divided into two parts—(1) report, (2) appendices. The first part deals mainly with the diagnosis and treatment of venereal diseases, and contains nothing that was not known before. Premier consideration is given to diagnosis by laboratory methods and not by clinical means; indeed, clinical work finds practically no place at all in the report. In discussing the substitutes for salvarsan, neo-kharsivan is mentioned second, although the employment of this drug has long ceased owing to the severe toxic symptoms following its use, while galyl, the safest arsenical substitute there is, appears to have been added as an after-thought. Inadequate summaries of reports regarding the drugs in question are published, and no place is found for reports, which show that the arsenical substitutes for salvarsan and neo-salvarsan are more toxic than the last-named drugs. The following quotation from the first report published is interesting:—

"In his opinion, Kharsivan is quite an efficient substitute for salvarsan, and it is not, on the whole, more toxic than the German product, except in the case of certain batches."

This obviously means that the reporter considered kharsivan to be more toxic than salvarsan. Since such batches

would not have been circulated had they not passed the biological controls, it proves the correctness of the statement I made last year, viz., that "it is futile to rely upon biological tests to tell whether a drug is safe for wholesale use on human beings."¹

Arsenical substitutes for salvarsan have been made in Canada, the United States, and in Japan, as well as in this country, and the general opinion expressed is, that they are more toxic than the German products. Further reference to this subject will be found later in the article.

The second part of the report consists of a series of articles which can roughly be divided into two groups: (1) those dealing with the laboratory diagnosis of venereal disease, and (2) those dealing with statistics. Nowhere is to be found the diagnosis of venereal disease by the naked eye—the best method at our disposal. Space is devoted to a description of the *spirochæta pallida*, and to the theory and practice of the Wassermann reaction; indeed, illustrations accompany the articles. It is difficult to see why a report should contain text-book matter, especially matter which could have been written in Germany nearly ten years ago.

These articles have been written specially for the report, and were printed, if the views expressed conformed with the doctrine of the German syphilitic trinity, *i.e.*, adherence to the *spirochæta pallida*, the Wassermann reaction, and Ehrlich's theory of chemotherapy. No articles containing views which are not in accord with the above are included in the report. Hence, progress was not one of the aims of the Commissioners; in fact, nowhere can we find a suggestion that research into venereal disease should be encouraged.

There is no doubt that the suggestion that the *spirochæta pallida* is not the sole cause of syphilis, but only the adult male form of the leucocytozoon syphilidis, was not at all welcome, and this is how the difficulty was overcome. When questioned about the life-cycle of the organism of syphilis, a paragraph was read out to me by Dr. Mott from an article written by Dobell, who showed that *spirochætæ* had no life history, and, if anything, they were more akin to the bacteria than to the protozoa. On looking up the

¹THE PRACTITIONER, December, 1915.

article afterwards, I found that Dobell expressly stated that none of his investigations were made with the *spirochæta pallida*; needless to say, this paragraph was not read out.

The *spirochæta pallida* resembles, morphologically, the *spirochæta* which causes Vincent's Angina as closely as it does the spermatozoon of the ray. Therefore, it is just as reasonable to say that the *spirochæta pallida* is the spermatozoon of a certain fish, as to say that its life history is similar to that of other *spirochætæ*. Many bacteria are morphologically the same, and some even resemble fungi, but it is not logical to assume that, if one form spores, so they all must. It will be of interest, while discussing this subject, to draw attention to a statement made by Lieut.-Col. Harrison.¹ He says:—

"Mr. McDonagh published his first description of the life-cycle of the micro-organism of syphilis, unless I am mistaken, in 1912. It appeared in English and German periodicals, and Mr. McDonagh read a paper on the subject at the last International Congress, so I think we can safely say that it has been widely read. He has shown his specimens here and at other societies, including the Pathological Society of Great Britain, so that many expert microscopists have seen them. Further, it is probably true that most biologists who are interested in the subject are favourable to the idea of the micro-organism of syphilis having a life-cycle. It is an idea which has been in vogue almost since the *spirochæta pallida* was discovered, and it is quite certain that biologists all the world over would be eager to take up any work on the subject. Yet, does it not seem strange that not a single word of confirmation of Mr. McDonagh's interpretations has appeared in print from any microscopist of standing? Actually, to-day, the *leucocytozoon syphilidis* has not found a single friend outside its birthplace."

This last statement is incorrect, since my work has been repeated and confirmed by Peyri, of Barcelona, and by Klausner, of Prague.

Here, then, we have two diametrically opposed opinions by observers who do not appear to have repeated any of the work. If the idea prevails among biologists, that the micro-organism of syphilis has a life-cycle, I cannot understand why they should be so long in beginning to work it out. The fact, that biologists have not proved my work on the *leucocytozoon syphilidis* to be wrong, is one of the greatest

¹ *British Journ. of Dermatology*, 1916, XXVIII., 216.

points in favour of its correctness, for there seems to be a particular delight, in English medicine, to point out the fallacies of others. Furthermore, none of us are ignorant of the fact that the longer a view in medicine takes to be accepted, the more correct it is, and *vice versâ*. Medical history teems with instances.

It is fortunate that Lieut.-Col. Harrison refers to German periodicals, because certain facts can now be brought to light which will have to be faced and avoided in the future, if British medical science is ever going to be raised from the depths to which it has fallen. My object in publishing the work in Germany was in order to prevent the Germans repeating the work and introducing it into this country as their own discovery, where it would immediately have been accepted. This was a favourite trick of the Germans, for none were more cognizant of the petty jealousies which divide us than they. I had the greatest difficulty in getting the work published, and one editor of a well-known journal in Vienna was foolish enough to write me, saying that the publication was impossible, for the work caused considerable annoyance to the professors of the city.

Returning to the document under discussion, pages 160 and 161 are devoted to a preliminary report of the sub-committee of the section of Pathology of the Royal Society of Medicine on the methods of carrying out the Wassermann test. An attempt is made to standardize a test, the *rationale* of which was not only unknown, but of which no one could, at that time, definitely say how the results obtained should be interpreted. I have always failed to understand why the Commission thus wasted the time of the members of the sub-committee. Surely the best procedure to have adopted would have been to ask those members to unravel the mysteries of the reaction, and to attempt, if possible, to substitute it by a simple and rational reaction.

Coming to the statistics, we not only find that they are valueless and, in many places, contradictory, but some savour of being altered so as to give greater colour to the point discussed. Medical statistics, especially those relating to the effects of treatment, are not only useless but actually misleading. Some years ago, the medical officers of Rochester

Row Hospital issued statistics as to the value of the treatment of syphilis by one, two, and three injections of salvarsan, at a time when, in England, and still more so on the Continent, several injections of salvarsan were advocated, to be followed by mercury for one to three years as before. In spite of the results obtained and tabulated in those statistics, we find that, in 1916, the Army Order is to give several injections of salvarsan—a course found to be necessary just four years ago. In the meantime, the statistics have remained, becoming more misleading as their age ripens. They are quoted from, and most of the medical men in this country are still under the impression that two or three injections of salvarsan are going to cure syphilis.

Summing up the recommendations of the Commission, or rather those which have since been amplified by the Local Government Board, we may say that the number of clinics is to be increased, where the patients may get free treatment, and have the necessary, or, as it would be more correct to say, the unnecessary, pathological examinations made, also free of charge. The establishment of clinics is a step forward, for every student will be able to make himself conversant with matters venereal.

That the pathological work should be separated from the clinical work, and done by a pathologist who takes no special interest in venereal diseases, is bad. All pathological and clinical work should be done by the head of the clinic, with the aid of his assistants. As the medical officer's clinical knowledge increased, his recourse to pathological diagnosis would diminish, thereby saving much time and money, not to mention the lessening of the period of infectivity of the individual being examined. If men appointed to clinics combined their pathological and clinical work, the keenest of them would soon be stimulated to make investigations into questions which are yet far from being solved. It is only from such men that advancement in the scientific aspect of venereal diseases will come, and this appears to me to be the soundest way of discovering preventive measures, which will, in the end, turn out to be the only means of really diminishing the diseases in question. Neither now nor for some time past has, practically speaking, any research work dealing with venereal diseases been undertaken in this country. Most of

us are still spell-bound by the German syphilitic trinity, most of which I hope to be able to prove in this article is false. We have not only worshipped this trinity, but an attempt has been made to get a standardized method of both diagnosing and treating syphilis—fortunately for us, unsuccessfully.

The next point we have to consider is the question of free treatment. I am strongly of opinion that this move will be void of success. At general hospitals, the practice which is most in vogue is that patients pay nothing, while, at most of the special hospitals, they contribute something at each visit. When special departments were started at the general hospitals, the patients attending the special hospitals did not diminish, showing clearly that the average hospital patient is not adverse to paying what he can afford. At the Lock Hospital, we have made those who can afford the money, pay for their salvarsan, and the profit that is made goes partly to pay for the drug given to those, who can afford nothing. I have been amazed, during the last few years, at the paucity of the patients attending the Lock Hospital, who could not afford to pay for their salvarsan. I have noticed, further, that those who pay are more regular in their attendance than those who do not pay, and it is characteristic of human nature to regard as of little account things obtained free, and *vice versa*.

The embodiment of the Australian scheme, which is notification and treatment by specialists, is certainly an advance on our scheme, in so far as it entails something definite; but, as I shall now attempt to show, no scheme, however perfect, is going to do more than improve the lot of those infected. It is not going to stop, or even notably to diminish, the spread of infection. A scheme which relies upon treatment is nothing more than a case of *clipeum post vulnera sumis*.

SUGGESTED SCHEME FOR DIMINISHING VENEREAL DISEASES.

Education of the public and all eugenic measures are necessary; they appear to be getting now into full swing, and will, without doubt, do much good, because they aid in preventing infection. Treatment, even if curative, will improve the life of those infected, but it will not stop the

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why do we never see it divide, and why are not two injections of salvarsan able to cure syphilis when they are able to kill every spirochæta in the body? The spirochæta pallida does not divide, because it is an end phase, or the male form of the life-cycle of a coccidial protozoon, whose function is to fertilize the female form thereof. Salvarsan does not cure syphilis because its action upon the other forms of the protozoon is not so destructive as that exerted on the spirochæta pallida. This difference in action is due to the varying chemico-physical constitution of the phases.

THE RESISTING SUBSTANCE OF THE HOST.

The presence of organisms in the body calls forth certain protective bodies, and the production of the latter is more pronounced in protozoal than in bacterial infections. In syphilis, the cell which most responds to the call is the lymphocyte. The lymphocytes form plasma cells, which attack the parasites locally; and protein particles, which circulate in the serum and attack the parasites generally. These protein particles have received, amongst several others, the name of antibody. These protein particles are colloidal particles, *i.e.*, they give a typical Tyndall cone, when exposed to a strong beam of light, and exhibit Brownian movement when the serum, in which they are suspended, is examined by the ultra-microscope. To the naked eye, they are not visible, with the result that the general impression prevails, that serum is a liquid containing protein in solution. Serum is a medium consisting of a liquid and a solid phase. The liquid or external phase is a saline solution, while the solid or internal phase is made up of these colloidal particles. These colloidal particles contain water, and have salts attached to them. In virtue of the water they contain, they appear to be in solution, and are called hydrophile or emulsion colloids. If these emulsoid particles are robbed of their water and salts, they become precipitated, when they are known as suspension colloids. Suspension colloids are very sensitive to univalent ions, while emulsion colloids are not; for instance, aluminium hydroxide is readily precipitated by the chlorine ion in sodium chloride, while the protein in serum is not. From this it follows, that the

spread of the disease for two reasons : (1) the damage has been done before treatment has been begun ; (2) the infecting person is usually ignorant of harbouring the disease. Men now come up for treatment earlier than was the case, but women practically never seek advice until the rash compels them to do so. It is a rare sight to see a woman with a chancre as her only sign. The majority of women do not know when they were, and are, infected ; therefore, they are a continual source of danger, which neither notification nor anything else will lessen.

The whole matter summed up comes to this : that nothing short of prevention is going to diminish the spread of venereal diseases. All we can do at present is to aid those infected, and strive to discover some preventive measures. Preventive measures are what we are in need of most, and such measures are most likely to come from men who are confining themselves to the study of venereal diseases, and combining pathological and clinical work. The best way to get such men is, as I suggested some time ago, to make whole time appointments, to be held by one or more men in every town which has a population of over, let us say, roughly 30,000 inhabitants. These venereal specialists would in no way be hampered, for the treatment, etc., in vogue at each town would be that which the specialist himself deemed the best. Every incentive should be given to the men appointed to do research work, the incentive being in the form of money promised, according to the practical value of the research work done. The best men would soon come to the fore, and they would be judged by the merit of the work they produced.

THE CAUSE OF SYPHILIS.

Having dealt with the ethical side of venereal diseases, I will now pass on to the scientific. Two allusions have already been made to what I think may aptly be called "The German Syphilitic Trinity." The doctrine of this trinity maintains that the *spirochæta pallida* is the sole cause of syphilis ; that a positive Wassermann reaction signifies that the patient has active syphilis ; and that Ehrlich's salvarsan cures syphilis, owing to its parasitotropic properties. If the *spirochæta pallida* is the cause of syphilis

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colloidal particles in the serum must always be in the perfect emulsoïd state, and they are kept in this state by what is known as the normal hydrogen ion concentration. This normal hydrogen ion concentration is maintained interdependently both by the internal and external phases, and represents nothing more or less than that extremely mystifying substance—complement.

THE WASSERMANN REACTION.

The antigen in the Wassermann reaction is a colloidal suspension, the particles being of the emulso-suspensoid type, *i.e.*, neither purely emulsoïd nor purely suspensoid. Emulso-suspensoid particles will adsorb salts in the attempt to become purely emulsoïd; therefore, if they are added to a protein "solution" such as serum, in which the normal hydrogen ion concentration is maintained, they will upset the latter when the balance of the salts is disturbed. In the disturbance of the normal hydrogen ion concentration, complement is in part or wholly destroyed, a phenomenon which goes by the name of "complement fixation."

As already stated, the particles in serum are emulsoïd particles, but the character of these particles varies in different diseases. In syphilitic sera, the particles are not only larger than they are in normal sera, but they are much more numerous as well. A syphilitic serum can be differentiated in a second from a normal serum by the ultra-microscope, an examination which renders the Wassermann, or any other reaction superfluous. When one has become accustomed to examine sera in this way, a pretty good guess may be given, whether a serum is from a late or early case of syphilis, or whether it is the serum of a patient who is under treatment or has recently been so. In early syphilis, the particles are very numerous, and there are many large ones; in late syphilis, the particles increase in size more than in number. In treated syphilis, the particles are all the same size, small, and exceedingly numerous. Syphilitic protein particles differ from normal protein particles in other respects: first, the former have a greater adsorptive capacity than the latter; secondly, they have more adsorbed amino-groups; and, thirdly, they have more adsorbed ions. In virtue of their greater adsorptive capacity, they will readily adsorb antigen, a physical

action which causes an unequal balance of salts, a phenomenon which destroys complement, if present. The syphilitic complement fixation test is not specific, since the antigen need not come from a syphilitic source.

Bearing this in mind, I tried to see whether an hæmolytic system could be prepared, in which the amboceptor was not specific, analogous to the complement fixation test just described. I found that aluminium hydroxide would serve as well; therefore, it is not necessary to use rabbit's serum immunized against the red blood corpuscles of the sheep. The characters of the protein particles alter when sera are left standing, or are subjected to alterations of temperature, or of atmospheric pressure. Such alterations are more or less marked in different normal sera, and they tend to make normal sera give a positive Wassermann reaction. These points and others, which can be studied more fully in my *Biology and Treatment of Venereal Diseases and Links in a Chain of Research on Syphilis*, lead me to state that the Wassermann reaction is a purely physical reaction, that a positive reaction allows the presumption to be made that the patient has had syphilis, but that it does not necessarily signify that the disease is active, or that the patient requires treatment.

A NEW TEST FOR SYPHILIS.

As the ultra-microscope is not likely, at present, to be used on a large scale, owing to the expense of the apparatus and other considerations, I have attempted to evolve a simple test, which would bring out the points revealed by that instrument. If serum is added to glacial acetic acid, the particles increase in size, lose their ions and, consequently, their Brownian movement, and become converted into a state of gelation. Later still, the particles become dissolved in the acid, and fail to give a Tyndall cone. When more glacial acetic acid is added, the particles are thrown out of solution, owing to the further abstraction of water from them. This precipitation can be accelerated by electrolytes. The changes just mentioned are influenced in degree by the number and size of the particles present; therefore, a syphilitic serum can be differentiated from a normal serum by the rapidity

with which a precipitate forms. This test I have called the "Gel" test for short, and it is carried out as follows:—

From 5–20 c.c. of blood are taken from the vein, and the blood is allowed to clot in order to allow the serum to separate out. It is better not to use a centrifuge, and the serum should not be incubated. An opaque serum or one tinged with hæmoglobin may be used. The serum should not be more than a few days old. In order to carry out the test satisfactorily, it is necessary to have both a negative and a positive control, *i.e.*, a known non-syphilitic and a known syphilitic serum, because the time of year and the temperature of the room have an influence upon the reading of the results.

Four c.c. of glacial acetic acid¹ are now placed in a clean dry test-tube, to which is added 1.0 c.c. of the serum to be tested. The tube is then shaken.

For every serum to be tested, four test-tubes are taken, *i.e.*, if there are six sera, including the two controls, a rack holding 24 tubes will be required.

One c.c. of glacial acetic acid is first added to each tube. Then into A tube, 2 drops of the acid serum are placed; into B, 4 drops; into C, 6 drops; and into D, 8 drops. The drops should be as small as possible; therefore, a pipette is made out of narrow-bore glass tubing, tapering finely at the end.² Needless to say, the same pipette must be used for each series of tests, since the results obtained vary with the size of drop used. After the serum has been added and the tubes shaken, 0.2 c.c. of a saturated solution of lanthanum sulphate in glacial acetic acid is added to each, and the tubes are again shaken. The tubes are then left undisturbed, and the changes noted. In the positive control, a precipitate soon forms in D, then in C, A, and B, or C, B, and A. Half an hour or so later, the precipitate has fallen in all four tubes, leaving a clear solution above in tubes A and D. Later still, the solution becomes clear in the other two tubes.

In the negative control, the precipitate forms slowly, but, in time, it appears in all the tubes, but the supernatant liquid does not become absolutely clear in all four tubes, even if left over till the next day; therefore, it is the easiest thing possible, not only to differentiate a syphilitic from a non-syphilitic serum, but also to tell the grades of positivity, and thereby gauge accurately the effect of treatment. I have tried this test on over 550 sera, controlling the first 200 by the Wassermann reaction, with the result that I am more than satisfied with it, and consider the latter super-

¹ The glacial acetic acid must be B.P. If it contains more water satisfactory results can be obtained, but they differ from those about to be described.

² The pipette I use contains 8 drops per 0.1 c.c.

fluous. In the 200 sera, one gave a strong positive and two a slight positive Wassermann reaction, although the patient had never had syphilis, so far as I could tell. By my test, these three sera were negative. Out of these 200 cases, 37 gave a negative Wassermann reaction, when the test should have been positive. By my test, all these sera were positive.

The increase in the number and size of the protein particles, *i.e.*, in cases of primary syphilis, can be detected by this new method more rapidly than by the Wassermann reaction. In the generalization stage of syphilis, a serum in which the particles are very fully laden with electrolytes may give a negative Wassermann reaction; in the recurrent and late stages, a negative Wassermann reaction is frequently obtained, owing to the influence that fatty acids have upon surface tension; finally, normal sera, in which the protein particles have been rendered partly suspensoid, will always give a positive Wassermann reaction. These are disadvantages which can never be foreseen by the observer, and none of them influence the "Gel" test sufficiently to lead to a false reading being made.

The Gel test is influenced by two factors: (1) the number, and (2) the size of the protein particles. A precipitate most readily forms when the protein particles are small and very numerous; hence sera, taken from patients who are being treated by intravenous injections, give the most positive results. In a few cases of late syphilis, when the change in the particles is an increase in size rather than in number, the formation of a precipitate may take even longer than it does with the control normal serum. Such sera, examined under the ultra-microscope, show no increase in number, but only an increase in the size of some of the protein particles. Summed up, it can be said that a precipitate occurs most rapidly when the protein particles are small and increased in number; then, when they are increased in number as well as in size; then, when they are normal; and finally, when they are increased in size only.

To obtain uniform results, it is advisable to test all sera drawn off on a certain day at the same time. The acid serum should be freshly prepared as well, though those prepared a day or more beforehand can be used, provided fresher sera are not included in the same series. If the same sera are tested day by day, varying results are obtained.

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THE RATIONALE OF CHEMOTHERAPY.

As already stated, the protein particles in a syphilitic serum have a greater adsorptive capacity than those in a non-syphilitic serum. Adsorption is regulated by the colloidal state of the particles and by certain chemical groups of the particles. Adsorption is more decided with emulsoids than with suspensoids, in virtue of the amino-groups the former possess. Salvarsan and the other synthetic anti-syphilitic remedies are emulsion colloids, and the amino-groups are the most important groups in their molecules. Until my experiments proved what has just been stated, the general opinion held, was that arsenic was the most important group in the salvarsan molecule, and it was said to kill the parasitic cells directly without injuring those of the host. In the first place, no emulsion colloid can be injected intravenously without becoming adsorbed by the protein particles, the main protective agents of the host. In the second place, there is no difference between the protein particles of the protoplasm of the plasma cells in a case of syphilis, and those in the serum, except that, in the former, they are enclosed in one fixed place instead of circulating freely in the serum as they do in the latter.

Therefore, not only does the emulsion colloid injected become adsorbed by the protein particles in the serum, but by those of the plasma cells as well; hence, it is wrong to say that salvarsan is not organotropic. As a matter of fact, the organotropic properties of a drug are all important, and I may state here that neither arsenic nor any other element is an essential ingredient of an anti-syphilitic remedy, for any emulsion colloid will have a marked therapeutic action, in view of the peculiar physical properties exhibited by the syphilitic protein particles. From this it is clear that intramine and ferrivine must have a beneficial action in syphilis, apart from the sulphur and iron they respectively contain, since both are emulsion colloids. Doubtless Lieut.-Col. Harrison was unaware of this principle

depending upon the ease or difficulty with which the colloidal particles are robbed of their salts by the glacial acetic acid.

Instead of lanthanum sulphate, either a saturated solution of thorium sulphate or nitrate in glacial acetic acid may be used. The precipitate is formed most rapidly with thorium sulphate, then with thorium nitrate, and finally, with lanthanum sulphate. According to the Hofmeister series, the precipitating power of the sulphate anion in an acid medium is greater than that of the nitrate anion, but the precipitating power of thorium nitrate is greater than that of lanthanum sulphate, for the probable reason that the atomic weight of thorium is greater than that of lanthanum.

If the precipitate forms too quickly, or if the observer is called away before he has read his tests, all that is necessary is to add 0.1 c.c. of a solution containing 10 c.c. of water and 7.5 c.c. of glacial acetic acid to each tube, and to shake them on his return.¹ The precipitate then partly goes back into "solution," but more completely in the case of a negative serum than in the case of a positive serum; therefore, a syphilitic serum can be differentiated from a normal serum by the greater degree of gradient opacity in the four tubes of the former. The difference is particularly clear when thorium nitrate is used.

If 0.2 c.c. of the electrolyte originally used be now added, down comes the precipitate again, in the positive tubes (syphilitic), quickly; in the negative tubes (non-syphilitic), slowly. The difference between a syphilitic and normal serum can, in this way, be judged best when thorium sulphate is used. With thorium nitrate, and still more so with lanthanum sulphate, the secondary precipitation occurs very slowly. There is a difference, too, in the kind of precipitate formed, which should be noted. This re-precipitation can even be repeated more than once, especially with thorium sulphate, but, on the third occasion, it takes some hours to form. The results obtained from this procedure depend upon the amount of the water originally used. The results obtained are largely dependent upon the quality of the glacial acetic acid used, so much so that, with some samples, it is not necessary to add an electrolyte in the first

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adsorption; this active oxygen is formed directly by iron hydroxide, and indirectly by a di-sulphide.

Since we do not know the chemical formula of the protozoal protein particles, it is impossible to synthesize a compound homologous to them. Therefore, the only way in which we can assist the host is to increase his supply of active oxygen, which we do directly with arsenic, aluminium, and iron, possibly with antimony and mercury as well, and indirectly with iodine and sulphur.

From these remarks it will be seen, that the employment of arsenic only fulfils half the therapeutic programme, and that a complement is necessary, which intramine—a sulphur compound—supplies.

My theory of oxidation and reduction has been strongly attacked by Prof. Bayliss, but as the bitterness and bias of an attack always bear a direct ratio to the correctness of the views attacked, one can only take it as a compliment. If the correspondence referred to be read carefully, it will be found that Prof. Bayliss's only argument against me rests in the fact, that I have used certain technical terms in a sense which does not meet with his approval, *inter alia*, adsorption and chemical combination. No argument has been brought forward to disprove my theories, or to uphold those of Ehrlich. Whether metals and non-metals form active oxygen and active hydrogen respectively, or only influence, in some way, the action of the hydroxyl and hydrogen ions, is a point which cannot finally be settled as yet. There is no doubt that the action of the hydroxyl and hydrogen ions is influenced by their substrata, so to speak, *i.e.*, by the varied chemico-physical constitution of the bodies to which they are adsorbed. It is even possible that what we regard as active oxygen and active hydrogen *in corpore* are only expressions of the hydroxyl and hydrogen ions influenced by certain chemical groups in the bodies to which they are adsorbed.

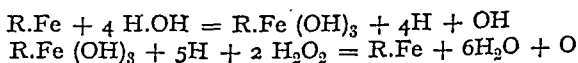
Many proofs, both clinical and otherwise, have been brought forward, which strongly support my theory of oxidation and reduction; these will be found in my *Links in a Chain of Research on Syphilis*. The object of my thesis was not so much to prove that oxidation and reduction was the probable solution of chemotherapy, as it was to show that arsenic does not act as Ehrlich thought. I am

when he stated that the action of both was "absolutely nil." To this subject I will return later.

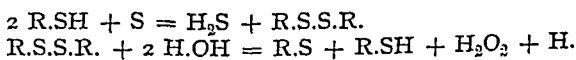
The question of the value and action of the arsenic has now to be considered. Arsenic does not attack the parasites directly, with the exception of the adult male phase and the female phase after impregnation. My own view is that it increases the formation of active oxygen, which, together with the active hydrogen formed by a non-metal, helps to regulate the hydrogen ion concentration of the internal phase, or the protein particles themselves, and the two act respectively as oxidizing and reducing agents.

Oxidation, in the sense I am now using it, implies the formation of active oxygen, and reduction the formation of active hydrogen. Both active oxygen and active hydrogen are formed by ferments, which have been called respectively oxidases and reducases. For an oxidase to form active oxygen, the presence of a peroxide is necessary, and it is in the reducase system that this peroxide is formed; therefore, reduction assists oxidation.

Oxidases are hydroxides of metals, and their action can be represented diagrammatically in the two following equations:—



The reducase system can be represented diagrammatically in the two following equations:—



From the above equations, it will be noted that non-metals increase the production of active hydrogen. Moreover, it will be seen how extra active oxygen can be produced in the serum of the host; directly, by the administration of strongly adsorbed metallic compounds, and indirectly, by the administration of strongly adsorbed non-metallic compounds. Without treatment, the lesions of syphilis vanish, because the protein particles of the serum and the plasma cells contain a stereo-chemical molecular configuration, homologous to those of the parasitic protein particles—an homology which is necessary for perfect adsorption—and because they contain active oxygen for the

in the ladder was put in by Thomas, who found that atoxyl was valuable in trypanosome infections, and Thomas's paper was published long in advance of Koch's report on the treatment of sleeping sickness by atoxyl. If it had not been for Fournau, the exploitation of the French product by Germans, who doubtless hoped to deceive the world that atoxyl was their own discovery, it is possible that the identity between the atoxyl of German origin and the ortho-arsenilide of Béchamp would never have been exposed. The next in the field to work with atoxyl were Moore, Nierenstein, and Todd, who showed that atoxyl was, in all probability, not an anilide, but a sodium salt of an organic acid containing an amidogen group and an arsenic radical directly united to a benzene ring. Later, Ehrlich and Bertheim published a paper showing that atoxyl was para-amino-phenyl-arsenic acid.

From this time onwards, all the compounds prepared contained arsenic and were aniline derivatives, since Ehrlich had, in some earlier experiments, noted that a few dyes, such as trypan red, etc., had a parasiticide action on trypanosomes. These experiments with dyes are rather interesting, since they show how much in the dark Ehrlich was as to the action of chemotherapy. The only dyes which had a spirillicidal action were those belonging to the ortho-quinonoid group. The spirillicidal action still remained, if the oxygen atom was replaced by nitrogen, sulphur, or selenium. The main groups common to pyronin, di-amino-acridin, tryptoflavin, tri-amino-phenyl-azoxonium chloride and tri-amino-phenyl-azo-selenium chloride are the ortho-amino-phenyl groups; yet Ehrlich prepared various arsenical compounds before salvarsan, the one which contains amino-groups in the ortho position. Even when salvarsan was discovered, Ehrlich never saw that the therapeutic action of salvarsan was mainly due to its ortho-amino-phenyl groups, because of the part these play in the important phenomenon of adsorption.

It is extremely interesting to note once more how incorrect the statement made by Lieut.-Col. Harrison and Capt. L. Mills must be, namely, that the action of intramine in syphilis is absolutely nil. Intramine, as will be seen later, is an ortho-amino-thio-benzene compound, and therefore comes into line, not only with the ortho-amino-phenyl-

certain that we are wrong in thinking that any element has a selective action on certain cells, when injected into the body. After all, it was only owing to *in vitro* experiments that this view was ever originated, and no *in vitro* experiments dealing with the action of drugs can ever be taken as representing their action when injected into the body. As I have said already, a drug when injected comes into contact with, and is altered by, the protein particles in the serum, long before it can reach the cells for which it is supposed to show an affinity.

There are three metals which have an extremely powerful bactericidal action *in vitro*, not one of which can be said to cure a generalized bacterial infection. I am referring to arsenic, antimony, and silver. The only powerful fungicide *in vitro* is copper, an element which is practically valueless in fungous diseases. Other metallic elements, again, readily kill protozoa *in vitro* but not *in corpore*. *In vitro*, no non-metallic element is either a powerful bactericide, fungicide, or protozoocide, but, nevertheless, *in corpore*, in certain cases of late syphilis, sulphur, as in intramine, has an action far surpassing that of salvarsan. This being the case, is it necessary to continue using an element so toxic as arsenic? Is it not possible to supplant that metal by iron—the metal which normally controls the oxidation process in the body? As sulphur in intramine has proved such a great success, and as sulphur is the non-metal which normally controls the reduction process in the body, all efforts should at least be made to prepare a suitable iron compound.

HISTORY OF ARSENIC AS A CHEMOTHERAPEUTIC AGENT.

Before dealing with the use of intramine and ferrivine in the treatment of syphilis, I should like to go a little more fully into the history of salvarsan than I was able to do last year. An interesting article by Moore¹ gives more exact information concerning the earlier work done on the arsenic compounds, which ultimately led to the discovery of salvarsan. Béchamp, as already stated, discovered the mother substance, namely, atoxyl, a name invented by the Lanolinfabrik Martinikenfelde; it was erroneously described as an anilide of arsenious acid, in order to throw chemists off the track. The next rung

¹ *Brit. Med. Journ.*, 1916, I., 616.

substitution products, which I have either seen myself, or about which I have had letters, since the war started:—

Six cases of sudden death;

Fourteen cases of generalized arsenical dermatitis, two of which died;

Eleven cases of mild or localized arsenical dermatitis;

A fatal case of cerebral degeneration after an intraspinal injection of serum drawn off after galy;

Three cases in which the symptoms of degenerative myelitis were very much aggravated, and the degeneration increased, by the use of serum injected intraspinally, after the administration of kharsivan and galy;

Five cases of very severe neurasthenia;

Four cases of arsenical neuritis;

Seven cases of jaundice;

An uncertain number of cases of shock. The symptoms varied from loss of pulse to difficulty in breathing, with asphyxia and swelling of the lips and tongue.

LUARGOL AND OTHER METALS AS CHEMO-THERAPEUTIC AGENTS.

Recently an anti-syphilitic drug, named luargol, has been invented by Danysz. Luargol contains arsenic, antimony, and silver. Note that these are three metals, which Crookes showed, in 1911, had a considerable bactericidal action. Luargol is, therapeutically extremely active, probably more so than salvarsan. It has the disadvantage of sometimes causing venous thrombosis, but this will, no doubt, soon be overcome. At the Lock Hospital, where it has been well tried,¹ no cases of anaphylactic shock have occurred, but as a ratio exists between the severity of such shock and the atomic weight of the metal employed, and between the toxicity of an element and its bactericidal properties, I cannot help thinking, that we are rather playing with fire, when we use such toxic metals as arsenic, antimony, and silver. I have lately had the fortune to see certain correspondence which passed between Ehrlich and the late Mr. Henry Crookes. I must first state that the pioneer work on the action of metals on bacteria was done by Mr. Henry Crookes. On the Continent, his work was well known, although his name was never mentioned, possibly because it was taken for granted that his work would not receive recognition in his own country. When Ehrlich learnt from Crookes that the bactericidal properties of antimony and

¹ Bonard: *Lancet*, 1916, II., 554.

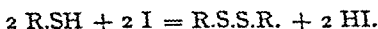
preparations just referred to, but with that interesting compound, thiazine as well. Thiazine was first prepared by Kehrman—it is an ortho-quinonoid body, in which the oxygen atom has been replaced by sulphur—therefore it is analogous to selenazine, not only chemically, but in its spirillicidal action. From these facts, it is theoretically impossible alone for intramine to have other than an extremely beneficial action in protozoal diseases.

One of the reasons why Ehrlich chose arsenic was, because the greatest difficulty of preparing organic compounds containing it had already been overcome, although by a Frenchman. When salvarsan was first made, in its process of manufacture, the two stages of nitration and reduction were, doubtless, employed as stated in the patents. In 1912, when the potency and toxicity of salvarsan diminished, I am of the opinion, from experiments I have made, although I have no actual proof, that the process of manufacture was altered, and that the stages of nitration and reduction were avoided. In the preparation of organic compounds, like salvarsan, etc., the nitration and reduction processes are liable to alter the element's relationship to the benzene ring, in such a way that some of it immediately becomes ionic when injected intravenously. Unfortunately, there is no means of detecting this beforehand. If some of the arsenic acts as an ion when it gets into the blood stream, it immediately increases the hydrogen ion concentration, destroys complement, and alters the emulsoïd character of the protein particles, with the result that alarming symptoms supervene or sudden death occurs.

The symptoms are those of anaphylactic shock, and this upset of the normal hydrogen ion concentration, with the concomitant change in the colloidal state of the internal phase, is the only rational explanation of that mystifying subject—anaphylaxis (*vide* Chapter VIII., *Links in a Chain of Research on Syphilis*). The arsenical substitution products for salvarsan are more toxic than even the German products manufactured before 1912, owing to the fact that the element is not properly combined; therefore, as I have already stated, neither kharsivan, novarsenobenzol, diarsenol, etc., are physico-chemically the same as salvarsan and neo-salvarsan.

I now append a list of the cases treated with arsenic

Later still, I discovered that the previous use of iodine enhanced the therapeutic effect produced by intramine, because the iodine combines with the mercaptan group, which results from the breaking down of intramine, and thus prevents this group from exhibiting its affinity for oxygen.



I have given now over 500 injections of intramine, and I am convinced, that it is not only a very powerful non-toxic anti-syphilitic remedy, but that, when combined with metallic drugs, so many injections of the latter are not required. Intramine is most useful in removing the induration of chancres—those dense, infiltrated papules, and certain gummatous lesions, which are practically uninfluenced by salvarsan. When intramine was first used, it was suspended in an oily vehicle, which was largely responsible for the pain it caused. Whether intramuscular injections are painful or not, depends largely upon the site selected for the injection. The material must be injected into the gluteus medius muscle; it must not come into contact with fibrous tissue or bone. From a photograph published by Capt. Mills, who complained so bitterly about the pain produced by intramine, it is clear that the drug touched the iliac bone—distilled water injected into the same site would have been almost as painful. As oil prevents proper absorption, I turned my attention to the preparation of an isotonic vehicle, and, as the action of a colloid depends upon the surface of the particles, I tried to diminish the size of the intramine particles, with the result that I have now succeeded in preparing a fluid suspension of intramine which possesses the following properties:—

1. It will go through the finest bore needle.
2. Not more than 2·5 c.c. need be injected into each buttock.
3. It is readily absorbed.
4. The pain is negligible.
5. The therapeutic action is enhanced.
6. It can be injected intravenously (dosage, etc., not yet estimated).

Intramine, then, as it is now prepared, is, in my opinion, not only one of the most active drugs we have, but it is as

silver were much the same as those of arsenic, an attempt was made to incorporate silver in salvarsan, but the finished product proved too toxic.

Copper was the next metal which engaged Ehrlich's attention. Why so is not very clear, since, from the correspondence which passed between Ehrlich and Crookes, the latter pointed out that copper had practically no bactericidal action.

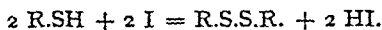
It is possible that Ehrlich, just before he died, realized that the metallic group in the compound was not the only important group, and that it did not kill the parasites directly. Probably many more cases of severe arsenical poisoning occurred than ever got into print, which, if a fact, would be known to Ehrlich, and I cannot help thinking that Ehrlich was endeavouring to supplant the arsenic by other and less toxic metals. After all, it is only logical to suppose that a ratio exists between the parasitotropic and the organotropic properties of a metal. The three metals possessing the greatest parasitotropic action—namely, arsenic, antimony, and silver—are also three of the most toxic. Furthermore, not one of these metals is normally to be found in the body. Until my theory of oxidation and reduction was propounded, in which iron and sulphur were the elements indicated for future research in chemotherapy, since their occurrence in the body is both natural and essential, the prevailing opinion was that the action of a metal (the use of a non-metal had occurred to no one) depended upon its parasitotropic properties. To show how false such a view is, I need only state here, that iron has practically no bactericidal action, and that sulphur even stimulates their growth *in vitro*.

SULPHUR, IRON, AND IODINE AS CHEMOTHERAPEUTIC AGENTS.

As this part of my work has been published so recently, and owing to its length, I must beg the reader, who requires further information than that to be obtained here, to refer to my book, *Links in a Chain of Research on Syphilis*.

The most suitable sulphur compound so far prepared is di-ortho-amino-thio-benzene, or intramine, as it is called for short. As a result of experience, I have found that, in early syphilis, intramine should succeed, but that, in recurrent and late syphilis, it should precede a metallic compound.

Later still, I discovered that the previous use of iodine enhanced the therapeutic effect produced by intramine, because the iodine combines with the mercaptan group, which results from the breaking down of intramine, and thus prevents this group from exhibiting its affinity for oxygen.



I have given now over 500 injections of intramine, and I am convinced, that it is not only a very powerful non-toxic anti-syphilitic remedy, but that, when combined with metallic drugs, so many injections of the latter are not required. Intramine is most useful in removing the induration of chancres—those dense, infiltrated papules, and certain gummatous lesions, which are practically uninfluenced by salvarsan. When intramine was first used, it was suspended in an oily vehicle, which was largely responsible for the pain it caused. Whether intramuscular injections are painful or not, depends largely upon the site selected for the injection. The material must be injected into the gluteus medius muscle; it must not come into contact with fibrous tissue or bone. From a photograph published by Capt. Mills, who complained so bitterly about the pain produced by intramine, it is clear that the drug touched the iliac bone—distilled water injected into the same site would have been almost as painful. As oil prevents proper absorption, I turned my attention to the preparation of an isotonic vehicle, and, as the action of a colloid depends upon the surface of the particles, I tried to diminish the size of the intramine particles, with the result that I have now succeeded in preparing a fluid suspension of intramine which possesses the following properties:—

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Intramine, then, as it is now prepared, is, in my opinion, not only one of the most active drugs we have, but it is as

well one of the least toxic, and has a much wider sphere than salvarsan, for it is useful in all chronic infections. Injected into the urethra through a catheter, it is extremely useful in cases of chronic perifolliculitis with stricture formation. Intramine causes no pain when injected into the urethra, but it may set up a transient dermatitis if allowed to get on to the skin of the penis or scrotum. In cases of gonorrhoeal arthritis, it has proved most useful; in lupus vulgaris, it has wrought changes which have never been produced by any other drug, and, applied locally to chronic ulcers, it has been invaluable.

My first experiments with iron were undertaken with ferric hydroxide, which I protected with agar, albumen, glycerine, or gelatin. Ferric hydroxide, as an emulsion colloid, had a therapeutic action in syphilis and was non-toxic, but the results obtained were not as good as those which followed salvarsan, for the simple reason that the iron was not attached to a benzene ring which had amino-groups in it.

The best organic compound I could prepare was the ferric tri-para-amino sulphonate. The therapeutic action of this salt was, in many cases, superior to that of salvarsan, but, owing to the readiness with which suspensoid ferric hydroxide formed, when the salt reached the blood stream, cases of anaphylactic shock were not infrequent. I was then compelled to protect ferrivine—the name given to the compound for short—which I did with gelatin. Ferrivine, thus protected, did not produce anaphylactic shock; it was entirely non-toxic, but, unfortunately, its therapeutic action was diminished. The more stable an organic compound is the less therapeutic action it has, because it is not so readily broken down; this is one of the reasons why galyl is not quite so potent as salvarsan. Feeling confident, as I do, that iron strongly attached to the benzene ring will give results as good as those obtainable with salvarsan, and that its use could never produce toxic symptoms, which too often follow in the wake of arsenic, I have been endeavouring to prepare a strongly adsorbed organic ferric compound. Unfortunately, up to the present, I have not been entirely successful, and one's difficulties have been increased by the facts, that no such compound of iron has ever been prepared, that iron is a much more difficult metal to work with than arsenic, and that I have

not a host of chemists at my disposal like Ehrlich had. Nevertheless, much ground has been covered, and there is every reason to believe that success will come in time. Therefore, all I can say now, is that the protected ferrivine is useful in some cases, for it has some therapeutic action; it has a great tonic effect, and it still further reduces the number of the arsenical injections that have to be given. My usual practice is to give an injection of ferrivine 48 hours after the first injection of colloidal iodine, and before an arsenic preparation is employed; then, may be, to repeat it after the intramine, or after the first galy, which follows the intramine.

My researches with iodine have proved that the element acts as a reducing agent, and that this accounts for its greater therapeutic action in late than in early cases of syphilis, as is the case with intramine. As a reducing agent, properly used, it has proved to be of so much value in early syphilis, that it should be employed in all cases of syphilis, and not only in late cases, as hitherto has been the rule.

The preparation of organic compounds of iodine, possessing a therapeutic action at all akin to intramine, is impossible, owing to the fact that iodine is a monovalent element; hence my experiments have been undertaken with colloidal iodine, an emulsion colloid prepared at the Crookes's laboratories by my friend, Mr. Ward. As a result of experiments, I found that 300 c.c. of the so-called collosol iodine could be injected intravenously with impunity. I then noticed the effect it had upon the protein particles, which was to break down all the big particles into many small ones, thereby increasing the surface exposed; consequently I thought that, if injected before an arsenic compound, it would still further diminish the number of arsenic injections required. Apart from the effect of collosol iodine on the size of the protein particles, it increases the amount of the peroxide for the metal to act upon, and readily unites with a mercaptan group, thereby indirectly increasing the action of intramine.

Collosol iodine can also be injected intramuscularly and taken internally. When prescribed by the mouth, it is more active than potassium iodide, and it practically never causes iodism. Having used collosol iodine regularly since the beginning of the year, I have come to the con-

clusion that 100 to 300 c.c. should be injected intravenously 48 hours before a course of the metallic and non-metallic compounds is begun, and that two or more teaspoonfuls, taken three times a day after meals, may be prescribed in preference to the potassium salt.

OUTLINE OF TREATMENT OF SYPHILIS.

In the primary stage, I prescribe first of all collosol iodine (100-300 c.c. intravenously) and, 48 hours later, inject intravenously a large dose of a metallic compound, which I repeat one or two days later. Three days after the second injection, I give an intramuscular injection of intramine (5-10 c.c.), and, between the fourth and seventh day after, I inject intravenously another maximum dose or two of a metallic compound, and continue mercury, intramine, and iodides for one year, as follows:—

(1) Eight fortnightly intramuscular injections of grey oil, 2 gr. to 3 gr. of mercury.

(2) Eight fortnightly intramuscular injections of intramine, 1 c.c. to 3 c.c., Mercury and intramine alternately. By injecting mercury and intramine alternately, the former is prevented from producing salivation, tender gums, and local accumulations in the muscles.

(3) One month in every three, collosol iodine should be prescribed (3ii. ter. p.c.). The first month of iodine should be commenced after four doses each of mercury and intramine have been injected.

(4) One month's rest should follow every eight injections, each of mercury and intramine.

In the generalization stage, I prescribe collosol iodine at once as above, and two or three intravenous injections of a metallic compound, both before and after one or two intramuscular injections of intramine, allowing two to five days to intervene between each intravenous injection. I then give four courses of the mixed mercury, intramine, and iodine treatment, and, two months after the last intravenous injection, I inject intravenously a maximum dose of a metallic compound, before and after a large intramuscular injection of intramine, to prevent the onset of cerebro-spinal syphilis, which is so liable to occur about this time.

In all recurrent and late cases, I first of all give one or two intramuscular injections of intramine, preceded 48 hours by an intravenous injection of collosol iodine, then one or two intravenous injections of a metallic compound, and follow this up with one course of the mixed treatment. This

treatment will serve as well for cases of non-degenerative meningo-encephalitis and myelitis. In cases of degenerative encephalitis and myelitis, in which more drastic treatment might be expected to give more satisfactory results, I give the following :—

(1) An intramuscular injection of intramine, 48 hours after collosol iodine.

(2) Four days later, an intraspinal injection of prepared serum which has been drawn off on the third day.

(3) Three or four days later, an intravenous injection of a metallic compound. The metallic compound should not be galy, kharsivan, neo-kharsivan, or any of the other French substitution products for salvarsan, because they are too toxic.

(4) Three days later, an intraspinal injection of prepared serum, which has been collected the day before.

The injections of non-metallic and metallic compounds should be continued alternately, until the cerebro-spinal fluid is normal or approaching close thereto.

Women who are pregnant should be treated as first described under the heading of the generalization stage, and two courses of the mixed treatment should be given without any pause between. The extra injections at the second month are unnecessary.

Congenital syphilitics should have the mixed treatment for two years, with the exception that the mercury should be administered *per os* and continuously. All recurrent symptoms should be treated symptomatically, and intravenous injections prescribed, if practicable, as suggested in recurrent and late cases of acquired syphilis.

CASES TREATED WITH INTRAMINE, FERRIVINE, ETC.

CASE 1.—J. S. A medical student had a papulo-erosive chancre on corona, which was very indurated. Patient had one intravenous injection of collosol iodine and two intravenous injections of galy without producing much change in the sore. Intramine was then injected intramuscularly. About nine hours later the induration began to disappear, and, on the third day, it would have been difficult to say that a sore had been present at all.

CASE 2.—S. W. The patient had a primary sore on the corona, hard infiltrative cedema of the whole of the penis, and a generalized papular syphilitic eruption. No improvement followed three intravenous injections of galy; instead, more papules appeared. Within

ten days after one injection of intramine, every lesion had vanished.

CASE 3.—W. A. Patient had a definitive intra-urethral sore, general indurative lymphangitis and lymphadenitis, and a maculopapular rash. March 28, 1916: Intravenous injection of ferrivine (300 c.c.). April 15: Intramuscular injection of intramine (1 grm.). April 29: The sore had completely vanished, leaving no induration nor narrowing of urethra behind. The rash had disappeared, and the patient felt extremely well.

I have notes now of 48 cases of primary sores in which the induration vanished within a week after the injection of intramine.

CASE 4.—M. J. A patient had a gumma, which encircled the corona and spread over the under surface of the penis on to the scrotum. In less than one week after receiving only one intramuscular injection of intramine (2 grms.), the ulceration had completely healed. If this case had been treated with salvarsan alone, it would have taken about three weeks for the sores to have healed up, and, during this time, it would have been necessary to have given two or three intravenous injections.

CASE 5.—J. K. Syphilis 30 years ago; two primary sores; treated for one year with mercury internally. Ten years ago the patient's feet swelled at night, and he was found to have albumen in the urine. Three years ago, gummatous ulcers on the tongue appeared. In consideration of the albuminuria, the patient was treated with mercury and iodides, and advised against having 606, with the result that the patient became gradually worse. When I saw him he had a gummatous ulcer on the tongue, and one on the inside of the left cheek; there was a considerable amount of albumen in the urine, a portion of which was globulin. Another interesting feature about the case was a periodical rise of temperature, which would last for a few days. Considering the healthy appearance of the patient, I felt sure that the proteinuria was due to syphilis. I gave the patient 2.5 c.c. of intramine, and, two days later, the mouth had so much improved that the patient could smoke a cigar, which he had not done for years. A week later the intramine was repeated, by which time the ulcers in the mouth had completely healed. The amount of protein in the urine had also very considerably diminished. Two injections of galyl were then given, but, before the second had been injected, all the swelling of the legs had completely disappeared, so had the puffiness in the eyes, and the patient declared he had never felt so well for years.

CASE 6.—C. M. Syphilis 15 years ago, bad syphilitic glossitis for seven years, for which he had been treated with six injections of salvarsan and mercury and iodides, without any improvement. On examination, the tongue was swollen, lumpy, and fissured all over, and was covered with irregular patches of ulceration. On the same day that 10 c.c. of intramine were injected, the tongue began to feel

better. Two days later, the patient could take hot drinks, and, within a week, the tongue had only the scars of the healed ulcers left to show how bad it had been.

I have treated 19 cases of syphilitic glossitis with intramine, always with results as those just cited.

CASE 7.—E. M. Case of malignant syphilis. On examination, patient was found to have several ulcers scattered about the body, with one large one practically covering the whole deltoid region of one arm. The nasal septum was perforated, and there was an acute periostitis of the left nasal bone, which was on the point of bursting through the skin. The patient was first given an intravenous injection of colloidal iodine, with the result that all the ulcers discharged to such an extent that the dressings had to be changed several times a day. Two days later, and again two days after that, intravenous injections of ferrivine were prescribed. Five days later, by which time a great improvement had been wrought, galyl was injected. Three days later, and again a week later, intramine was injected and followed at weekly intervals by two more injections of galyl. After the second injection of intramine, every lesion had vanished, and the nasal gumma did not perforate the skin. This case is especially interesting, for the patient had had three injections of galyl before I saw him.

CASE 8.—O. T. Syphilis contracted August, 1915. When first seen, patient had a maculo-papular rash. Treatment consisted in eight intravenous injections of galyl and two courses of intramuscular injections of grey oil and iodides. In April, 1916, patient complained of headache, "stuffy sensation" in both ears, and slight blurring of vision. On examination, pupils were found dilated; there were signs of bilateral optic neuritis, and all the reflexes were much exaggerated. An examination of the cerebrospinal fluid revealed the typical features of a cerebro-spinal meningitis. The patient was given one intravenous injection of colloidal iodine, two intramuscular injections of intramine, and three intravenous injections of ferrivine, with an intrathecal injection of the prepared serum after each, with the result that all the signs and symptoms of the trouble vanished.

I have had five other cases similar to the above, which responded in the same way to the drugs in question. Although these cases of cerebro-spinal meningitis are steadily on the increase, and actually due to syphilis, I cannot help thinking that the toxic metal arsenic acts as a predisposing ætiological factor.

CASE 9.—R. J. Syphilis 12 years ago; typical case of degenerative myelitis, with a large perforating ulcer of the foot. Under one

injection of intramine, the ulcer completely healed.

I have had since another case in which an acute perforating ulcer healed under intramine.

CASE 10.—E. B. Girl, aged 25, congenital syphilitic, sought advice for double interstitial keratitis, which had remained uninfluenced by mercury and salvarsan. Besides the keratitis, the patient had syphilitic onychia of the index fingers of both hands. Under one injection of intramine, the lesions completely disappeared.

CASE 11.—T. M. A case of lupus vulgaris affecting nose, upper lip, and both nasal ducts. The lesion was studded with apple jelly nodules. The patient had been treated by the usual means, including X-rays and radium, for six months, with little or no improvement. After the first injection of intramine, the nose appeared more inflamed, but showed considerable improvement after the second injection. Besides the intramine, the patient had two injections of ferrivine. The following is what the doctor wrote me after the completion of the treatment:—"There is no doubt that the condition is decidedly better. The reddened area is smaller, and what remains is less angry. The apple jelly nodules on nose and corner of mouth have dried up, and the whole thing looks and feels (to the patient) better."

CASE 24.—J. F. Patient had an *ulcus molle* on the penis, which, in spite of active treatment for more than six weeks, showed no sign of healing. An intramine dressing was applied and kept on for 12 hours. In two days the sore had completely healed.

These cases, I think, prove conclusively that intramine and ferrivine have an anti-syphilitic action. Such being the case, and since it is obvious to me that the therapeutic action of the latter drug can be enhanced, and since sulphur and iron never produce such ill-effects as those I have related as occurring under arsenic, I feel that not a stone should be left unturned to promote the spirit of mutual co-operation, and to make ourselves pioneers in a field, which has not yet been exploited by Germany. When the improvements which suggest themselves have been forthcoming, I feel certain that our treatment of syphilis will be better than it has been with salvarsan, because I am perfectly convinced that, however rapidly salvarsan may get rid of symptoms, it most certainly does not cure syphilis.

In conclusion, I wish to thank Dr. R. L. Mackenzie Wallis, Mr. J. Patterson, and Mr. J. Ward for the invaluable assistance they have given me.

KERATODERMIA BLENORRHAGICA.

BY E. GRAHAM LITTLE, M.D., F.R.C.P.

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 Physician to the East London Hospital for Children,
 Shadwell, etc.*

[With Plates IV.-V.]

THE publication of the Report of the Royal Commission on Venereal Diseases has stimulated attention, perhaps somewhat too predominatingly, on the syphilitic section of such disease. The results of gonorrhœal infection, while often less dramatic than those of the sister disease, are probably a more widely disseminated, and, therefore, even more serious blight on the community. The unfortunate system that prevails, in England almost exclusively, of the separation of dermatological and genito-urinary diseases, which, on the Continent, are professed by the same specialist, renders it probable that many cases of the disease which forms the subject of this paper escape recognition. The dermatologist does not see gonorrhœal cases, whilst the genito-urinary expert does not recognize the dermatological complication which especially marks this peculiar syndrome. Its three cardinal symptoms are, in the usual order of their appearance, urethritis, arthritis, and a very exaggerated keratosis of the skin in several parts of the body, of which the plantar surface of the feet is the most constant site.

It is a remarkable circumstance that while the syndrome was very clearly apprehended and described by the great French dermatologist, Vidal, as long ago as 1893, no English instance seems to have been recorded until 1910, when Sequeira gave an excellent description of a case, which had been under the care of his colleague, Dr. F. J. Smith, and had escaped recognition.

This case was followed almost immediately by one reported by Winkelried Williams, and another recorded by myself and Douglas. In America, the disease seems to have been ignored for an even longer period, for the first instance

noted in American literature was contributed by Simpson in 1912, to be followed within a few months by a second American case—that published by Roark. I have been able to find record of only one other case in the English-speaking countries reported by Swift in Australia, in 1912, who explains that his attention was drawn to the disease by Simpson's excellent paper. All these cases are fully analysed in the table appended.

The syndrome marks a most formidable diseased state, of which the dermatological factor is not seldom the final and convincing clue to its nature, and is thus the means of securing the specific treatment which most speedily mitigates it. I propose, therefore, to analyse briefly the main points in the very small list of cases which have been recorded up to date. The first striking feature, on inspection of these records, is that the syndrome occurs apparently only in males, for the single instance in a woman—that reported by Robert—is a doubtful instance, the symptoms not having included arthritis. With this exception, all the instances have been in men. This is certainly remarkable, for women enjoy no immunity from the toxic effects of gonorrhœa, but arthritis occurs as well much less frequently in women than in men. Thus, in a series of 252 cases of gonorrhœal arthritis reported by Northrup, 230 were males. (Osler.)

The youngest age at which the syndrome was noted in this list is twenty years, for I have not included a case reported by Robert in a girl aged four, who had no arthritis, and in which the diagnosis is even more doubtful than the other case by the same author which I have somewhat reluctantly included.

Since it is the addition of the skin eruption, which differentiates these cases from the much more numerous instances of gonorrhœal urethritis associated with arthritis alone, it may be asked why this skin symptom is considered gonorrhœal. Absolute proof of the causal connection of the eruption with gonorrhœal intoxication is lacking, in so far as repeated attempts to find the specific coccus in the skin lesions have failed. In the absence of this proof, the most convincing evidence of this connection is found in the effect on the skin eruption of injection of gonococcal vaccines. Many cases have now been recorded in which this

treatment alone has caused a rapid disappearance of the skin lesions.

The association with urethritis is usually fairly definite, but, on the whole, considerably more remote in point of time than the association of arthritis with urethritis. It is apparent, from a consideration of the intervals elapsing between cessation of urethritis and the appearance of keratosis as well as of arthritis, that both these symptoms may develop when there has been quite a prolonged freedom from discharge. In Rost's cases, four years and five years respectively, in a case reported by Winkelried Williams, which constitutes a record, there were no symptoms of urethritis for some ten or twelve years prior to the full involvement of joints and skin. It would, in fact, seem as if a free discharge is seldom noted in immediate association with these remoter effects, and that absorption of the gonorrhœal poison, of which these symptoms may be regarded as the result, takes place most readily when the flow may be supposed to be checked. Favouring this view, that arthritis and keratosis are dependent on absorption, is the observation that the syndrome under discussion seldom occurs with the first attack of gonorrhœa, and, in confirmation of this observation, it may be noted that the age incidence is somewhat higher than that of uncomplicated urethritis. Other symptoms pointing to grave absorption are the profound general illness, wasting, fever, and cachexia, which are the rule.

The value of the skin symptom in deciding the diagnosis is great, for an obscure arthritis, in the absence of urethral discharge, may be, and, in fact, has been, frequently mistaken for "rheumatism," and so escaped the specific treatment, which may be instituted without any misgivings when the confirmation of keratosis has been added. Indeed, in more than one instance, the dermatologist has been instrumental in making the diagnosis of gonorrhœa, when this has been missed by the general physician, who is unfamiliar with the special significance of this symptom.

As has been indicated, the syndrome means a very serious toxæmia, and the patient is invariably and obviously extremely ill. Muscular wasting in particular may be so pronounced as to lead to confusion with the amyotrophic

paralyses, but the reaction of degeneration is never met with, and it is surprising how complete may be the recovery, with appropriate treatment, of a patient who seems to be at death's door. Fever is usually slight, seldom much exceeding two degrees above normal, but these moderately raised temperatures may be maintained for long periods. A rise is frequent in association with the administration of specific vaccines. Bedsores may occur, and should be watched for, the patient being often too weak muscularly to change his position without help. Reflexes are often increased, but with no constancy. Mental powers are usually unimpaired, save for an excessive psychological depression, which, in one instance in this list, led to the patient's suicide, after suffering two years of bedridden misery. Recurrence of all the symptoms may take place after apparent cure, usually as the result of a fresh gonorrhoeal infection. Several such instances are included in the sub-joined list.

As might be anticipated with so severe a constitutional illness, the skin appendages are frequently affected, the hair shed and the nails deformed, striated, split, or, as is noted in nearly half of the cases reviewed, they are exfoliated.

Thus the clinical picture is sufficiently striking. One sees an emaciated frame, lying motionless in bed, with bulbous joints contrasting forcibly with the shrivelled limbs, the integument like white wax, studded, in the affected areas, with nail-like elevations of hard, brownish-yellow, wax-like substance, and with the soles of the feet transformed into leather-like, irregular, heaped-up masses. The "typhoid smell" and "typhoid facies" complete an unforgettable impression of disease.

I propose now to consider in detail the cardinal features of the cases as tabulated. I have had four personal cases, of which three are noted in the table; the notes of the fourth are mislaid.

URETHRITIS.

The patient has usually had several attacks before arthritis and keratosis have been noted. In one case, that reported by Gibbs (number 32 in table), arthritis would seem to have preceded urethral flow, but this is entirely exceptional. Quite often the flow has apparently ceased for weeks, months,

or even years before the advent of keratoderma. In about half the cases, specific gonococci were found in the urethra or the urine, at some period of observation. In many instances, no mention is made of bacteriological examination of the urethral discharge.

ARTHRITIS.

Where possible, mention is made in the table of the interval which elapsed between the appearance or cessation of urethritis and affection of joints. The affection is almost always multiple, and, indeed, very extensive, as compared with commoner forms of gonorrhœal arthritis, which a recent and popular text-book describes as "seldom affecting more than two or three joints." The incidence of the arthritis may be usefully compared with a much larger series of cases from Finger of gonorrhœal arthritis uncomplicated by keratosis.

*Incidence in the cases
here tabulated.*

Knees	-	-	-	32
Feet	-	-	-	19
Ankles	-	-	-	16
Shoulders	-	-	-	12
Fingers	-	-	-	11
Hips	-	-	-	10
Elbows	-	-	-	6
Spine	-	-	-	6
Hands	-	-	-	6
Wrists	-	-	-	5
Toes	-	-	-	4
Sterno-clavicular	-	-	-	3
Temporo-maxillary	-	-	-	1

Total - 131

Finger's cases.

Knees	-	-	-	136
Ankles	-	-	-	59
Wrists	-	-	-	43
Digits	-	-	-	35
Elbows	-	-	-	25
Shoulders	-	-	-	24
Hips	-	-	-	18
Temporo-maxillary	-	-	-	14
Metatarsal	-	-	-	7
Sacro-iliac	-	-	-	4
Sterno-clavicular	-	-	-	4
Chondro-costal	-	-	-	2
Inter-vertebral	-	-	-	2
Tibio-fibular	-	-	-	1
Crico-arytenoid	-	-	-	2

Total - 376

There is nothing to differentiate the arthritis from that of ordinary "gonorrhœal rheumatism." Most of the writers lay stress on the entire absence of ankylosis, but, in Rost's three cases, general ankylosis was observed. The relative frequency of involvement of the sterno-clavicular joint is to be noted. The painlessness of what seemed to be a greatly inflamed and reddened finger-joint was a matter of surprise

in one of my personal cases.

THE SKIN ERUPTION.

Two types of skin lesion are most often observed either synchronously or within a short time of each other. Of these, the most constant is the keratoderma, which has given the justification for including this feature in the name given to the syndrome. Inspection of the tabulated cases shows that the soles of the feet are affected in by far the larger number of cases, and it is here that the keratoderma is most characteristic. Pressure, obviously, has an important share in the incidence of the keratoderma, for the parts of the sole, which come in contact with the ground when a man stands erect and barefooted, are the parts affected; the shape of the keratotic area is that of the impression of the naked foot on wet sand. All this area may be uniformly thickened, or in accentuated patches about the ball of the foot, the heel, and the ball of the toes. The skin may be deeply fissured owing to the inelasticity of the hardened integument, and an exquisitely tender surface may thus result. All degrees are met with, from a superficial hardening to the production of a leathery sole-like carapace, which may be an inch thick, or there may be medallion-like horny masses inserted into the thickened and crinkled skin of the foot. This may happen, but much less frequently, on the hand, as in one of Rost's cases, whose figure is here reproduced.

It is probable that these keratodermic patches originate, in the majority of cases, with the individual cone-like horny masses which constitute the second characteristic clinical lesion, and that the special conditions of the foot, encased, as it is, for the most part, in an impervious boot, transform this lesion into the appearances just described. In parts where these conditions do not obtain, the typical conical, brownish-yellow, waxy, pointed horn develops unchecked, and may reach a considerable elevation before it falls off. It can usually be readily dislodged, when its base is seen to be a reddened moist surface, with surprisingly little inflammatory infiltration, a point in which it differs from a rupial scab, with which it has probably occasionally been confused. The general appearance of the cones has been aptly com-

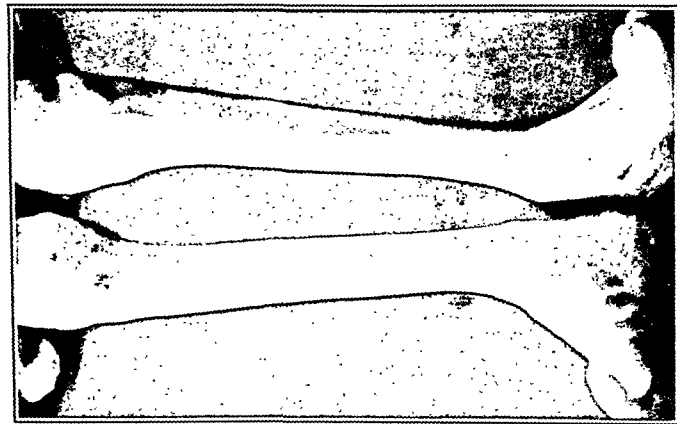


Fig. 1. - A typical picture of swollen joints and emaciated limbs. In front of right knee are some keratotic cones.



Fig. 2. Early pustular eruption with commencing cone formation. (After Rost.)



Fig. 3.—Keratodermic "medallions" on palm of hand.
(After Rost.)



Fig. 4.—Keratodermic patches on soles.

pared to the pointed nails with which one's climbing boots are studded in Switzerland. The cones, in their turn, probably begin as small pustules, and several cases have been described in which pustules remained the preponderant lesion. It will therefore be assumed that these three clinical types of efflorescence, keratotic patches, cones, and pustules, merely represent stages of the same affection, and in the following table, which endeavours to set out the usual distribution, differentiation has not been attempted of the particular clinical type present, but all have been grouped under the general term keratodermia, just as a book of short stories will take its title from the most striking tale included in it

Distribution.

Soles of feet	-	-	34	Ankles	-	-	-	5
Toes -	-	-	13	Thighs	-	-	-	5
Dorsum of feet	-	-	12	Palms	-	-	-	4
Legs below knee	-	-	10	Face	-	-	-	3
Penis	-	-	9	Scrotum	-	-	-	3
Hands	-	-	8	Abdomen	-	-	-	3
Trunk	-	-	8	Buttocks	-	-	-	2
Front of knees	-	-	8	Elbows	-	-	-	2
Fingers	-	-	8	Arms	-	-	-	2
Scalp	-	-	7	Sternum	-	-	-	1

The nails, especially those of the toes, are very characteristically implicated in a majority of the cases tabulated. Quite often the keratosis involves the entire bed of the nail, which is lifted off and often exfoliated. The tissue of the nail itself may show marked changes, indicated by thickening, striation, splitting, or general deformity. The toe nails are more often attacked than the finger nails because of the extension of the disease from the sole.

Mention is made, where this point is noted in the records, of the result of bacteriological examinations of the skin lesions. In all cases in which gonococci have been sought, they have not been found, but almost always the common staphylococcus has been freely grown from the keratotic and cone lesions.

HISTOLOGICAL CHARACTERS OF THE SKIN ERUPTION.

These have been investigated by numerous observers,

and there is fair agreement about the essential features, except that opinion differs as to whether there is hyperkeratinization, as claimed in his earlier investigations by Chauffard, who has had an exceptionally large personal experience, or a deficient keratinization (parakeratosis), which is the view put forward by Baermann and other more recent writers.

There is general agreement that there is considerable acanthosis, with œdema of the papillary body and infiltration of the epidermis and sub-epidermal zone of the corium with leucocytes, chiefly polynuclears; mast cells were found by Chauffard to be numerous, and to be absent by Turnbull. The stratum granulosum is defective or absent, and mitoses are frequent. Sections stained for micro-organisms have shown nothing definite. These findings are confirmed by Nathan, who contributes the latest and most elaborate account of the histology, based on a study of a case of his own, which appears in the annexed table. He adds to the general description just given the statement that there was much proliferation of the intima of the smaller arteries and leucocytic infiltration of their sheath and great enlargement and thickening of the elastic fibres of the media of the veins.

ÆTIOLOGY OF THE SKIN ERUPTION.

The earlier observers of the disease, writers of the French school, emphasized the constant combination of the three symptoms which constitute the syndrome, viz., urethritis, arthritis, and keratoderma. Jacquet and Jeanselme associated the eruption with trophic nerve disturbances, a view in which they have had little support. Chauffard lays stress on the contributory causes determining the incidence of the eruption, to be found in the lack of personal cleanliness of the patient, often the inevitable concomitant of the desperate illness which marks the disease, and in the effect of maceration of the skin, such as occurs, for example, under a Bier's bandage, by which means Chauffard was able to reproduce experimentally an eruption in a patient suffering from this disease. This would explain the preponderance of eruption on the feet. But the causation remains very obscure, and, in particular, the immunity of the female sex is unexplained.

PROGNOSIS.

Notwithstanding the formidable general illness which accompanies the symptoms, prognosis is by no means as grave as might be expected. A surprisingly large number of the tabulated cases ended in recovery, as may be noted on inspection of the last column of the table. The introduction of vaccine therapy has undoubtedly effected an immense improvement in the rapidity and prospect of cure.

DIFFERENTIAL DIAGNOSIS OF THE SKIN ERUPTION.

In early forms of the eruption, when the keratosis is moderate and the cones small, and in which the distribution is like that of psoriasis, this diagnosis has sometimes been made erroneously, as in a case under my own observation which had this label attached to it. In Williams's second case there was a concurrent eruption of typical psoriasis.

Psoriasis *ostreacea* or *rupioides* may simulate this appearance closely. An analysis of the sites attacked shows that the elbows are infrequently the seat of gonorrhœal keratosis, though the knees and scalp may fairly frequently be implicated, and so lend to confusion with psoriasis. The soles, however, are rarely selected for the chief incidence in psoriasis, and the profound cachexia is totally unlike the undisturbed and even robust health which is the rule with psoriatic patients.

The plantar and palmar keratoses, not gonorrhœal, usually classed under the general heading of tylosis, may be difficult to distinguish, but their behaviour is different, for they are far more intractable to treatment, and the wide distribution of cone-like elevations is absent. It is surprising with what rapidity and completeness the most formidable-looking gonorrhœal eruption will disappear, leaving no scar or sign. Absence of scarring differentiates this condition from the crustaceous and rupial syphilides, to which there is a certain resemblance, which is increased by the symptoms of severe general illness common to both diseases; in a few instances, no doubt, syphilis is a concomitant affection.

GENERAL SYMPTOMS.

Mention has been made of some of the more salient of these, of which extreme muscular wasting and weakness

are especially notable. In the case reported by Dr. Hayne and myself, the emaciation was extraordinary, and may be realized by comparison of the body weight with the height, a patient of 5 ft. 6½ in. weighing only 5 st. 10 lbs., which included blanket and jacket. Fever of a moderate degree is the rule, and may be sustained for long periods. Pulmonary complications are infrequent, and the respiration rate is fairly normal.

Myocarditis and endocarditis seem noticeably frequent. Tachycardia is a very prominent symptom. Ophthalmia, as might be anticipated, in some form is often met with, conjunctivitis and iritis being the commonest types. Anæmia is generally profound and intractable. Testicular disease, orchitis and epididymitis, are mentioned in a considerable proportion of cases. Renal and hepatic disorders are, on the whole, less frequent than might be expected with so grave and prolonged a toxæmia.

TREATMENT.

This may be considered under the same headings as the symptoms, namely, urethritis, arthritis, and the skin eruption.

Urethritis.—As has been noted in many cases, perhaps the majority, there is no active flow, and there may be no history of recent flow from the urethra, at the time when the arthritis and keratoses develop. When flow is present, its nature should be determined, and, if characteristic gonococci are present, an autogenous vaccine should immediately be made and used. When the nature of the flow is established by previous evidence, but gonococci are unobtainable, a stock vaccine should be used, and this is almost, if not quite, as effective as the autogenous variety. As vaccine treatment, in my experience and that of several others, is the most rapid means of controlling all three of the cardinal symptoms, to prevent repetition, the methods of giving this will be discussed here. Two schools of practice exist: one, which favours small doses, beginning with half a million and increasing this, with doses at short intervals, up to ten million; the other school gives a much larger initial dose, fifty or a hundred million, with a weekly increase, ultimately up to a thousand million or more. My own experience is with the latter method,

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Arthritis.—Although vaccines seem to influence this least of the three cardinal symptoms constituting the syndrome, yet they should certainly be given. Among adjuvant methods may be mentioned treatment of the affected joints by douches, or baths of super-heated air, by Bier's bandages, by passive movements, etc. Ankylosis, as has been mentioned, while apparently less common than in ordinary gonorrhœal rheumatism, may occur.

Keratosis.—The effect on the skin conditions of vaccine treatment is often remarkably rapid, as in the second case reported by Williams, in which the skin lesions disappeared within a week of beginning this treatment, which was by the method of small doses. To remove the hardened masses of horny matter, there is nothing better than repeated boric starch poultices or maceration of the hardened skin under occlusive dressings. Chauffard quotes a remarkable instance in which a coachman with gonorrhœal keratoderma of the soles was rid of the local hard masses as the result of keeping his boots on continuously for a week during a bout of intoxication. The same author lays much stress on the preventive value of personal cleanliness in avoiding the development of keratoderma, and recommends dressings of plain boiled water, and frequent soaping.

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Myocarditis and endocarditis seem noticeably frequent. Tachycardia is a very prominent symptom. Ophthalmia, as might be anticipated, in some form is often met with, conjunctivitis and iritis being the commonest types. Anæmia is generally profound and intractable. Testicular disease, orchitis and epididymitis, are mentioned in a considerable proportion of cases. Renal and hepatic disorders are, on the whole, less frequent than might be expected with so grave and prolonged a toxæmia.

TREATMENT.

This may be considered under the same headings as the symptoms, namely, urethritis, arthritis, and the skin eruption.

Urethritis.—As has been noted in many cases, perhaps the majority, there is no active flow, and there may be no history of recent flow from the urethra, at the time when the arthritis and keratoses develop. When flow is present, its nature should be determined, and, if characteristic gonococci are present, an autogenous vaccine should immediately be made and used. When the nature of the flow is established by previous evidence, but gonococci are unobtainable, a stock vaccine should be used, and this is almost, if not quite, as effective as the autogenous variety. As vaccine treatment, in my experience and that of several others, is the most rapid means of controlling all three of the cardinal symptoms, to prevent repetition, the methods of giving this will be discussed here. Two schools of practice exist: one, which favours small doses, beginning with half a million and increasing this, with doses at short intervals, up to ten million; the other school gives a much larger initial dose, fifty or a hundred million, with a weekly increase, ultimately up to a thousand million or more. My own experience is with the latter method,

which has certainly had excellent results. I have nothing special to say with regard to the local treatment of the urethritis.

Arthritis.—Although vaccines seem to influence this least of the three cardinal symptoms constituting the syndrome, yet they should certainly be given. Among adjuvant methods may be mentioned treatment of the affected joints by douches, or baths of super-heated air, by Bier's bandages, by passive movements, etc. Ankylosis, as has been mentioned, while apparently less common than in ordinary gonorrhœal rheumatism, may occur.

Keratosis.—The effect on the skin conditions of vaccine treatment is often remarkably rapid, as in the second case reported by Williams, in which the skin lesions disappeared within a week of beginning this treatment, which was by the method of small doses. To remove the hardened masses of horny matter, there is nothing better than repeated boric starch poultices or maceration of the hardened skin under occlusive dressings. Chauffard quotes a remarkable instance in which a coachman with gonorrhœal keratoderma of the soles was rid of the local hard masses as the result of keeping his boots on continuously for a week during a bout of intoxication. The same author lays much stress on the preventive value of personal cleanliness in avoiding the development of keratoderma, and recommends dressings of plain boiled water, and frequent soaping.

EXPLANATION OF TABLE.

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Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
—	—	—	—	Cure.
Both knees, right shoulder, right medius.	Scalp, face, trunk, palms, soles, ankles. Right knee, toes, fingers.	Cachectic and anæmic. Blepharitis and conjunctivitis.	Sulphate of soda, quinine.	Do.
Right hip, right knee, left shoulder, fingers.	Trunk, plantar surfaces, toes, palms, ankles, face, scalp, abdomen, buttocks, thighs.	Conjunctivitis, fever, great emaciation and feebleness.	Local application of carron oil.	Improvement.
Right hip. Both knees, ankles, and feet.	Feet and toe-nails.	Extreme anæmia.	Salol, local warmth.	Improvement of skin condition, arthritis persistent.
—	—	—	—	—
All joints, except hands.	—	—	Confinement to bed. Salicylates, morphia; injections of pot. permang.	Relieved, but not cured.
All joints, hands included.	Plantar surface, and toes.	—	—	—
—	Plantar surfaces	Double aortic murmur, much emaciation.	—	—
All joints, except knees.	Do.	Anorexia, fever, diarrhoea.	—	—
Knees and clavicular joints.	Do.	Orchitis, ophthalmia, resulting in loss of one eye.	—	—
Knees and ankles, and toes. Right medius	Glans penis, thighs, back, plantar surfaces, left hand.	Grave illness and fever. Kidneys and heart affected, amyotrophy, orchitis.	?	Convalescence.
Nil	Knees and limbs	Ophthalmia right eye.	—	—

	Reporter.	Sex	Age.	Bacteriology.	Arthritis.	Keratosis.	Nails.
I	Vidal: <i>Ann. de Derm.</i> , 1893, p. 3. <i>Bacteriology</i> , by Sabouraud.	M.	1st att., æt. 24. 2nd att. 3rd att., æt. 26.	? Nil in urethra. Nil in skin. Gonococci in urethra. Nil in skin.	Nil Multiple, 10 weeks after urethritis. Multiple, 10 days after urethritis. Multiple.	Nil Keratodermia and cones. 6 weeks after urethritis. Keratosis and cones.	— Exfoliation (hands and feet). Exfoliation of same nails of fingers.
2	Jeanselme: <i>Ann. de Derm.</i> , 1895, p. 525.	M.	1st att., æt. 24.	?	One week after urethritis.	Four weeks after urethritis. Keratosis and cones.	Exfoliation
3	Jacquet and Ghika: <i>Soc. Méd. Hôp. de Paris</i> , Jan. 22, 1897.	M.	1st att., æt. 14. 2nd att., æt. 20. 3rd att., æt. 21. 4th att., æt. 23. 5th att., æt. 25. 6th att., æt. 27.	? ? ? ? ? ?	Nil Arthritis Do. Do. Do. Do.	Nil Nil Nil Keratosis Do. Do.	— — Exfoliation — Swollen and exfoliated.
4	Chauffard <i>Soc. Méd. Hôp. de Paris</i> , 1897, p. 569.	M.	1st att., æt. 20. 2nd att., æt. 25.	— Gonococci in urethra. Not in skin.	Arthritis, 6 days after urethritis. Arthritis, 15 days after urethritis.	Keratodermia and cones. Keratosis a month after arthritis.	— ?
5	Robert: <i>Thèse de Paris</i> (quoted by Simpson).	F.	Æt. 32	"Urethro-vaginal gonorrhœa."	No arthritis	Cones	?

Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
—	—	Orchitis and cystitis.	?	Cured.
Feet and knees	—	Much muscular wasting.	?	Cured.
Do.	—	Emaciation, reflexes increased.	—	Cured.
Ankles, shoulders, right elbow, left wrist, right knee, feet, toes.	Toes, dorsum right foot, plantar surfaces, sacral surface, left scrotum prepuce.	—	—	Cured.
Left ankle, right ankle, right knee.	Soles of feet			
Left foot	Nil	—	—	Cured in 6 weeks.
—	Nil			
Left foot, hands, thumb joint.	Right plantar surface.			
Left foot swollen				
Right knee, hallux, spine.	Sole and dorsum of left foot and sole of right, left hand.	Conjunctivitis, epididymitis.	Pot. iod. and mercurial inunction.	Cured.
Ankles, knees, shoulders, right wrist.	Both feet (soles)			

	Reporter.	Sex	Age.	Bacteriology.	Arthritis.	Keratosis.	Nails.
6	Launois : <i>Ann. de Derm.</i> , 1899, p. 998.	M.	1st att., æt. 20. 2nd att., æt. 30. 3rd att. 4th att.	— Coli bacillus in urine; no gonococci. — —	— Multiple Multiple, a few days after urethritis. Multiple	— — Keratosis and cones.	— Nails thickened and exfoliated. — —
7	Stanislawsky : <i>Monatsbe- richte über Gesamt- leistungen a. d. Gebiete der Erkrank- ungen der Harn und Sexualap- paratus</i> , 1900, p. 643.	M.	Æt. 28	Gonorrhœal urethritis.	Multiple, three weeks after urethritis.	Keratosis	Exfoliation
8	Baermann : <i>Arch. Derm.</i> , 1904, LXIX., p. 363.	M.	1st att., æt. 27. 2nd att., æt. 32. 3rd att., æt. 34. 4th att., æt. 37. 5th att., æt. 37.	? ? ? ? Gonococci in urethra.	Present Nil Present Multiple —	Nil Nil Present Keratosis and cones, 6 weeks after arthritis. —	? — — ? ?
9	Malberbe : <i>Journ. de Mal. Cut.</i> , 1900. [Quoted by Simpson. Record not obtainable by me.—E. G. L.]	—	—	—	—	Cones	—

Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
—	—	Orchitis and cystitis.	?	Cured.
Feet and knees	—	Much muscular wasting.	?	Cured.
Do.	—	Emaciation, reflexes increased.	—	Cured.
Ankles, shoulders, right elbow, left wrist, right knee, feet, toes.	Toes, dorsum right foot, plantar surfaces, sacral surface, left scrotum prepuce.	—	—	Cured.
Left ankle, right ankle, right knee.	Soles of feet			
Left foot	Nil	—	—	Cured in 6 weeks.
—	Nil			
Left foot, hands, thumb joint.	Right plantar surface.			
Left foot swollen				
Right knee, hallux, spine.	Sole and dorsum of left foot and sole of right, left hand.	Conjunctivitis, epididymitis.	Pot. iod. and mercurial inunction.	Cured.
Ankles, knees, shoulders, right wrist.	Both feet (soles)			

	Reporter.	Sex	Age.	Bacteriology.	Arthritis.	Keratosis.	Nails.
10	Roth : <i>Munch. med. Woch.</i> May 30, 1905, p. 1041.	M.	1st att., æt. 32. 2nd att., æt. 35.	Nil Gonococci in urethra, not in skin.	Nil Right foot	Nil Keratosis and cones.	Nil ?
11	Chauffard and Froin : <i>Arch. de Méd. Exper. et d'anat. path.</i> , Sept. 1906, No. 3, p. 609.	M.	1st att., æt. 30. 2nd att. (6 months later).	Gonococci in urethra. Do.	Multiple, coinciding with urethritis? 11 days after urethritis.	Nil Nine months after first urethritis.	— Striation of nails.
12	Do.		Æt. 28	Gonococci not proved.	During urethritis.	Cones and Keratoderma, 2nd month after arthritis.	?
13	Chauffard and Fiessinger : <i>Bull. de Soc. Fran. de Derm.</i> , May, 1909, No. 5, p. 162.	M.	Æt. 26	?	Multiple, some days after urethritis.	Keratosis and cones, 3 months after arthritis.	Infoliation of some nails.
14	Chauffard and Fiessinger : <i>Ikonograph Dermatol.</i> Fasc. V.	M.	Æt. 22	Gonococci found in urethra. None in skin.	Multiple, eight days after urethritis.	Keratosis and cones, 12 days after arthritis.	?
15	Rivet and Bricout : <i>Bull. Méd.</i> , 1909, p. 851. [Quoted by Simpson. Record not found by me— E. G. L.]	M.	1st att. 2nd att.	— —	Multiple Multiple	Keratosis Keratosis	— —
16	Sequeira : <i>Transact. Roy. Soc. Med.</i> , March, 1910.	M.	1st att., æt. 25. 2nd att., æt. 31.	— ?	Nil Arthritis 2 weeks after urethritis.	Nil Keratoderma and cones 5 weeks after arthritis.	Nil ?
17	A. W. Williams : <i>Brit. Journ. Derm.</i> , Dec., 1910.	M.	1st att.	No gono- cocci in skin.	Arthritis 1 month after urethritis.	Keratoderma and cones 4 days after arthritis.	?

Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
Nil	Nil	General illness	Sod. salicylate	
Right foot cedematous, but joints not swollen, some crepitation in foot.	Both feet, inner side of ball of hallux, soles.	Profuse eruption appeared as well.	—	Cured.
Knees and ankles	—	—	Injection of pot. permang. Santal.	—
Ankles, hips, elbows, fingers, vertebral column.	Toes, plantar surfaces, heel.	Emaciation and muscular atrophy, fever.	Cauterization (actual cautery) to vertebræ.	Cure.
Left knee, shoulders.	Toes, soles	Emaciation, anæmia.	?	?
Knees, ankles	Dorsum of feet, toes.	Muscular atrophy	?	Cure.
Knees, vertebræ, jaw, clavicle, feet, wrists, shoulders.	Soles and dorsum of feet, ankles, front of legs, penis, buttocks, toenails.	Profound illness and wasting fever.	?	Skin condition well in 2½ months, arthritis in 4 months.
Polyarthritis, ankles, wrists, shoulders, spine.	Ankles, nerve side of feet.			
Polyarthritis	Heels, lower leg, soles.	—	—	Recovery in 2 months.
Both knees, right elbow, right sterno-clavicular.	Plantar surfaces and inner side of dorsum of feet.	Cachectic, anæmic, and wasted.	Gonococcal vaccine.	Convalescence.
Left knee, left ankle.	Plantar surfaces both feet; dorsum of toes left hand, left index, right little finger.	?	?	Convalescence.

	Reporter	Sex	Age.	Bacteriology.	Arthritis.	Keratosis.	Nails.
18	Little and Douglas: <i>Brit. Journ. Derm.</i> , 1911, Vol. 23, p. 360.	M.	1st att., æt. 28. 2nd att., æt. 30.	— No gonococci in urethra or skin.	— "Arthritis some weeks" after urethritis.	Cones Keratoderma and cones 6 weeks after arthritis.	— Exfoliated and inflamed.
19	Simpson: <i>Journ. Amer. Med. Assoc.</i> , p. 607, Aug. 24, 1912.	M.	28	Gonococci in urethra, nil in skin.	Six weeks after discharge.	Keratoderma and cones 6 months after arthritis.	Nails exfoliated (fingers and toes).
20	Roark: <i>Journ. Amer. Med. Assoc.</i> , Dec. 7, 1912, p. 2039.	M.	1st att., æt. 26. 2nd att. 3rd att.	Nil — —	Nil Arthritis Arthritis	Nil Keratosis Keratosis	— — All toe nails affected and exfoliated. Some finger nails exfoliated.
21	Baermann: <i>Arch. Derm.</i> , 1904, 69, p. 374.	M.	24	No gonococci in urethra.	Present	Keratosis and cones 5 months after arthritis.	Nails thickened and split.
22	Arning & Meyer-Delius' <i>Arch.</i> , 1911, v. 108, p. 3.	M.	29	Gonococci in urethra.	Multiple	Keratosis and cones.	?
23	Do.	M.	25	Gonococci in urethra, nil in skin.	Multiple	Keratosis and cones.	?
24	Do.	M.	24	Gonococci in urethra.	Present	Keratosis and cones.	?
25	Do.	M.	25	Gonococci in urethra.	Present	Keratosis and cones.	—
26	Do.	M.	1st att., æt. 20. 2nd att., æt. 28. 3rd att., æt. 46.	? — Gonococci present in urethra.	Nil Arthritis Multiple arthritis.	— Nil Keratosis and cones.	— — Nails deformed and fissured.

Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
—	Elbows.			
Both knees.	Plantar surfaces and dorsum of feet; left knee.	Grave illness, fever, wasting.	Gonococcal vaccine.	Convalescence.
Both ankles, knees, wrists, metacarpals, vertebrae, elbows, shoulders, right hip.	Legs, forehead, hands, fingers, ankles, palms and soles, trunk, scalp.	Grave illness and emaciation, anemia, albuminuria, iritis (blindness).	Vaccine and local treatment.	After being bed-ridden for 2 years, committed suicide.
—	"Soles of feet"			ure.
"Polyarthritis"	Soles, both feet, toe nails, dorsum, and ankle.			
Left ankle, both knees, left hip, right medius, right elbow, both shoulders.	Scalp, left arm, right hand, left ring finger, sternum, left knee, thigh, and back.	Fever (101°), tachycardia, general toxæmia, and grave anæmia.	Gonococcal vaccine, stock, and 25-250 million autogenous staph. vaccine.	
Left hand, left knee, foot.	Penis, scalp, finger-nails, toes and soles.	Conjunctivitis. Grave general illness.	Hot air to joints	
Both feet, right hallux, left hand, right knee.	Both soles, toes, penis.	Conjunctivitis, iritis.	?	Cured.
Right knee, right foot, left knee, left foot, palms.	Plantar surfaces, toes, shins and dorsum of feet.	Fever, epididymitis.	?	Cured.
Right foot	Inner edge, right foot, penis.	—	?	Cured.
Both knees and both feet.	Both soles, palms, dorsum of feet, back of leg.	Much muscular atrophy.	?	Cured.
Right knee, both feet.				
Left hip, feet, right knee, right medius, right hip.	Plantar surfaces	Grave general illness.	—	Cured and relapsed with same symptoms 3 months later.

	Reporter.	Sex	Age.	Bacteriology.	Arthritis.	Keratosis.	Nails.
27	Swift: <i>Aust. Med. Gaz.</i> , Nov. 1912, p. 549.	M.	1st att., æt. 29. 2nd att., æt. 35.	Gonococci in urethra. Staph. in skin scraping.	Arthritis Arthritis, 3 weeks after urethritis.	Keratosis and cones. Keratosis and cones.	— Nails raised and exfoliated fingers and toes.
28	Buschke: <i>Arch. Derm.</i> 1912, Vol. 113, p. 223.	M.	26	No gonococci in urine, nil in skin.	Multiple	Keratosis and cones.	Exfoliation
29	Sabotka: <i>Derm. Woch.</i> 1913, Bd. 56, p. 181.	M.	24	No gonococci in urethra, but in urine.	Multiple	Keratosis and cones, some weeks after arthritis.	Exfoliation fingers and toes.
30	Graham Little: (unrecorded 1913).	M.	30	?	Multiple	Keratosis and cones.	?
31	A. W. Williams: <i>B. M. J.</i> Oct. 10, 1914.	M.	About 40	?	Arthritis developed 15 years after urethritis ceased.	Keratosis and cones.	Nails raised from matrix, but did not exfoliate.
32	Ch. Gibbs: <i>B. J. D.</i> vol. 23, 1914, p. 433.	M.	34	Gonococci found in urine.	Arthritis preceded urethritis.	Keratosis and cones, about 4 months after arthritis.	?
33	Nathan: <i>Arch. Derm.</i> , Feb. 1916, p. 907.	M.	1st att., æt. 33. 2nd att., æt. 37. 3rd att., æt. 38. 4th att., æt. 39.	? ? ? Gonococci in urethra. Nil in skin.	"Gonorrhœal rheumatism." ? Multiple arthritis. Single joint	Eruption on body. Nature undetermined. Eruption. Nature undetermined. Keratosis 3 months after urethral flow began.	— — —
34	Rost: <i>Derm. Zeit.</i> , Bd. xvi. 7, H. 3, p. 233.	M.	1st att., æt. 28. 2nd att.	? ?	No complication. No complication.	— —	— —

KERATODERMIA BLENORRHAGICA.

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Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
Both ankles, left hip.	Dorsum and soles, both feet.	Very anæmic and wasted conjunctivitis.	Stock vaccine	No benefit.
Both knees shoulders, jaw, spine.	Front of knees and shins.	Fever, cachexia, iritis.	Urotropine and generous diet.	Improved
Right knee, left knee, left ankle, right shoulder.	Dorsum and soles of both feet and between toes, genitalia, fold of groin, pubes, left knee, back and scalp.	—	Local dressings, with boric acid.	Cured.
Left foot, right knee, left knee, left elbow, right ankle, hand, fingers.	Scalp, upper and lower extremities, trunk, genitalia, hands and feet.	Grave illness, anæmia.	—	Convalescence retarded by prolonged muscular atrophy.
Both knees.	Soles, elbows, knees, hands, simulating psoriasis.	Much wasting, fever and anæmia.	Gonococcal vaccine.	Recovery.
Right wrist and hand, right foot ankle, spine, left wrist, left foot, both knees.	Right hand and fingers, left hand, soles of both feet, left knee and thigh, right leg.	Had syphilis, and psoriasis in addition, much wasting.	Gonococcal vaccine.	Recovery.
Left ankle, right knee, hip, left knee, left shoulder, right wrist.	Dorsum both feet, both soles, between toes, both shins, groin, pubes.	—	?	?
Both hands, both feet.	—	Myocarditis, enlarged liver, œdema of legs.	—	Recovery.
Left foot	Pigmentation on prepuce. Keratosis of trunk, dorsum and sole of left and right foot. Keratotic cones on dorsum and edge of both feet.	Systolic murmur, fever, wasting, Wassermann's test negative.	Bed. Bier's band, 6-12 hours a day. Sandal oil urotropin inunction (mercur.), injection of neo-salvarsan.	Recovery in 6 weeks.
—	—	—	—	Recovery.
—	—	—	—	—
Nil	—	—	—	—

	Reporter.	Sex	Age.	Bacteriology.	Arthritis.	Keratosis.	Nails.
34	Rost— <i>cont.</i>	M.	Relapse	—	Arthritis	Keratosis	—
			3rd att.	—	Arthritis	Keratosis 11 years after 1st Gonorrhœa. 2 years after cessation of flow.	?
35	"	M.	1st att., æet. 24.	No discharge	Arthritis	Nil	—
			2nd att.	—	Arthritis	Keratosis and cones and pustules.	Toenails exfoliated. Nails thickened and broken.
36	Rost	M.	1st att., æet. 26.	—	Nil	Nil	—
			2nd att., æet. 30.	—	Arthritis 2 years after urethritis ceased.	Nil	Nil
			3rd att., æet. 33.	—	Arthritis "soon after urethritis."	Keratoderma and cones.	Nails of fingers and toes exfoliated.
			4th att.	—	Arthritis relapsed severely, 4 months after discharge ceased.	Keratosis and cones.	?
37	Little and Hayne: <i>Tran., R.S. of Med., June 1916, Derm. Sect., p. 159.</i>	M.	1st att., æet. 29.	?	Arthritis	Keratosis and cones.	?
			2nd att., æet. 36.	?	Nil	Nil	
			3rd att., æet. 53.	?	Nil	Nil	
			4th att., æet. 53.	Nil in urethra. Staph. alb. in skin lesion.	Arthritis 6 months after recovery of urethritis.	Keratoder. and cones, 4 months after arthritis.	Not exfoliated but slightly thickened.
38	Lange: <i>Deutsche med. Wochen., 1914, No. 10.</i>	M.	21	Gonococci in urethra, not in skin.	Arthritis 4-6 months after urethritis.	Keratosis and cones, 4 months after arthritis.	Nails all shrivelled, toenails thickened and loosened.

KERATODERMIA BLENORRHAGICA.

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Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
Knees	Feet and trunk	Muscular wasting.	—	Recovery.
Left knee, right ankle, swollen right knee, hip.	—	Grave general illness.	—	Ankylosis in many joints death.
Hips and knees	—	—	—	—
Both knees, hips, feet, right hand, left elbow.	Right hand, both knees, right forearm, pubes, thigh, buttocks, sacral fold, scalp, face, left hand, soles, fingers.	Emaciation, cachexia, fever tachycardia.	Salicylates	Ankylosis of several joints, death.
Joints not specified.	—	—	—	Ankylosis of many joints.
Both knees, feet, cervical spine.	Soles of feet, hands, face, scalp, trunk, shoulders, fingers.	Extreme muscular wasting, cardiac disease (preceded gonorrhœal).	—	Remained resistant to all treatment.
Elbows, shoulders, hands, fingers, toes, knees and feet.	Feet, hands, scalp, face, back.	Urethral structure, chronic nephritis.	—	—
Left knee	Both feet	—	—	—
Left knee, left foot, right knee, right foot, both ankles, hips, left fourth finger.	Soles and dorsum of both feet, front of leg, front of knees, front of thigh, back of right elbow, left forearm, scalp.	Extreme wasting and cachexia, fever, pyorrhea, urethral stricture, viscera normal.	Massage to joints, Tonics, quinine, arsenic and iron. Later, small doses of vaccine.	Still under observation.
Left ankle, left little toe, right medius, both knees.	Soles of feet, glans penis.	Very grave illness and wasting.	Confinement to bed, administration of gonosan, salol, arthrigon, urotropin, alcohol fomentations.	Recovery.

	Reporter.	Sex.	Age.	Bacteriology.	Arthritis.	Keratosis.	Nails.
34	Rost—cont.	M.	Relapse	—	Arthritis	Keratosis	—
			3rd att.	—	Arthritis	Keratosis 11 years after 1st Gonorrhœa. 2 years after cessation of flow.	?
35	"	M.	1st att., æet. 24.	No discharge	Arthritis	Nil	—
			2nd att.	—	Arthritis	Keratosis and cones and pustules.	Toenails exfoliated, Nails thickened and broken.
36	Rost	M.	1st att., æet. 26.	—	Nil	Nil	—
			2nd att., æet. 30.	—	Arthritis 2 years after urethritis ceased.	Nil	Nil
			3rd att., æet. 33.	—	Arthritis "soon after urethritis."	Keratoderma and cones.	Nails of fingers and toes exfoliated.
			4th att.	—	Arthritis relapsed severely, 4 months after discharge ceased.	Keratosis and cones.	?
37	Little and Hayne: <i>Tran., R.S. of Med., June 1916. Derm. Sect., p. 159.</i>	M.	1st att., æet. 29.	?	Arthritis	Keratosis and cones.	?
			2nd att., æet. 36.	?	Nil	Nil	
			3rd att., æet. 33.	?	Nil	Nil	
			4th att., æet. 33.	Nil in urethra. Staph. alb. in skin lesion.	Arthritis 6 months after recovery of urethritis.	Keratoder. and cones, 4 months after arthritis.	Not exfoliated but slightly thickened.
38	Lange: <i>Deutsche med. Wochens., 1914, No. 10.</i>	M.	21	Gonococci in urethra, not in skin.	Arthritis 4-6 months after urethritis.	Keratosis and cones, 4 months after arthritis.	Nails all shrivelled, toenails thickened and loosened.

KERATODERMIA BLENORRHAGICA.

Distribution of Arthritis.	Distribution of Keratosis.	Constitutional Symptoms.	Treatment.	Termination.
Knees	Feet and trunk	Muscular wasting.	—	Recovery.
Left knee, right ankle, swollen right knee, hip.	—	Grave general illness.	—	Ankylosis in many joints death.
Hips and knees	—	—	—	—
Both knees, hips, feet, right hand, left elbow.	Right hand, both knees, right forearm, pubes, thigh, buttocks, sacral fold, scalp, face, left hand, soles, fingers.	Emaciation, cachexia, fever tachycardia.	Salicylates	Ankylosis of several joints, death.
Joints not specified.	—	—	—	Ankylosis of many joints.
Both knees, feet, cervical spine.	Soles of feet, hands, face, scalp, trunk, shoulders, fingers.	Extreme muscular wasting, cardiac disease (preceded gonorrhœa).	—	Remained resistant to all treatment.
Elbows, shoulders, hands, fingers, toes, knees and feet.	Feet, hands, scalp, face, back.	Urethral structure, chronic nephritis.	—	—
Left knee	Both feet	—	—	—
Left knee, left foot, right knee, right foot, both ankles, hips, left fourth finger.	Soles and dorsum of both feet, front of leg, front of knees, front of thigh, back of right elbow, left forearm, scalp.	Extreme wasting and cachexia, fever, pyorrhea, urethral stricture, viscera normal.	Massages to joints, Tonics, quinine, arsenic and iron. Later, small doses of vaccine.	Still under observation.
Left ankle, left little toe, right medius, both knees.	Soles of feet, glans penis.	Very grave illness and wasting.	Confinement to bed, administration of gonosan, salol, arthrigon, urotropin, alcohol fomentations.	Recovery.

NOTES ON THE SANATORIUM TREATMENT OF INDUSTRIAL PATIENTS.

By IAN STRUTHERS STEWART, M.D.

Medical Superintendent, Ochil Hills Sanatorium.

THERE is no doubt that this war will have a far-reaching effect on the treatment of tuberculosis in this country. The present time of prodigious national expenditure must necessarily be followed by a period of national economy, which will retard the completion of schemes planned by the various counties, burghs, etc. In any case, it would seem to be wise to pause and consider what return is likely to be obtained from a very large capital expenditure and a corresponding current expenditure. In other words, is sanatorium treatment of industrial patients worth the money it will cost? In the opinion of the writer, it is, but only if certain conditions are rigidly fulfilled.

The results of treatment at any sanatorium will depend entirely on the class of case sent there. If the cases admitted are in the early stages, the result will be good, and *vice versa*. It is hoped that the following paper will make this clear. Then, again, early cases must be *sought for*, and this involves the setting up of an elaborate organization to bring such cases to light. It will have to be explained to the laity what a sanatorium really is and what its functions are.

The oft-quoted results of German State Sanatoria must be taken with reserve, for, in the majority of instances, only patients in the earliest stage of the disease are admitted.

The following statistics are based on the results obtained during one year, from August 1, 1915, to July 31, 1916, at this Sanatorium, where there are 140 beds for male industrial patients. The results, unfortunately, are very poor, but a study of the various tables, especially Tables III., IV. and V., will show the reason, viz., the late stage of the disease present on admission. Without doubt any other industrial sanatorium admitting unselected cases

SANATORIUM TREATMENT.

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In the opinion of the writer, effort should now be concentrated on the treatment of the early cases, for they alone are likely to regain their working capacity sufficiently to justify the great expense to the State. This must not be taken to indicate that advanced cases should be neglected, but merely that such cases will have to be treated by other, and, if possible, cheaper, methods than those of a sanatorium.

It must be clearly understood that the results set forth in this paper are those obtaining at the time of the patient's discharge from the sanatorium. If the same cases be reviewed, say, two years hence, the results will be considerably worse, for there is not the slightest doubt that many of the patients who are classed as "improved" will either be dead or unfit for work at the later date. This is made doubly evident by the fact that even now cases are applying for re-admission a few months after having been discharged.

Before going further, it is necessary to define the various terms applied to groups of cases, so that comparison may be made by other observers. All the following terms, except the last, apply only to the condition of the lungs as shown by clinical examination, no account being taken of the patient's general condition. Practically all cases, except those sent in to die, show very considerable improvement in their general condition after living for a time under sanatorium régime. Very decided improvement of the general health is, however, quite compatible with little or no improvement of the pulmonary lesion, which is shown by the fact that, in such cases, patients very quickly go downhill when they return to work and ordinary ways of living.

"*Improved*" is taken to mean that the physical signs are less evident than on admission, and that, by carefully graduated exercise, no toxæmia is induced though any excessive exertion may be followed by a more or less severe auto-inoculation.

"*Decidedly Improved*" indicates that the physical signs are much less distinct than on admission, and that moderate work does not produce toxæmia.

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lesions, whose sputum is negative, and who are able to do a full day's work of the hardest grade without showing any sign of auto-inoculation or losing weight to any extent.

"*No Change*" is used to indicate that the patient's chest condition is, as far as can be judged, the same on discharge as on admission. If toxæmia were present on admission, it would be present on discharge as well.

"*Worse*" means that the physical signs are more extensive or more definite on discharge than on admission, with perhaps the addition of a toxæmia which might not have been present when the patient first came under treatment.

"*Dead*" needs no explanation.

From August 1, 1915, to July 31, 1916, 566 male patients were admitted, 391 have been discharged, leaving 175. Of these, 135 were still under treatment on August 1, 1916, and the remaining 40 had either suffered from some form of tuberculosis other than pulmonary, or had stayed such a short time that their inclusion in the figures would have tended to give a false result.

Taking the 391 patients, all of whom suffered from pulmonary tuberculosis, we get the following results of treatment:—

TABLE I.

	Per cent.
"Improved"	17·13
"Decidedly Improved"	23·26
"Arrested"	18·15
"No Change"	25·31
"Worse"	11·76
"Dead"	4·34

These figures, as they stand, do not show that treatment has been very successful, although more than half the patients have been benefited. Some of the factors responsible for such poor results will be discussed in the latter part of this paper.

The most important group, from the point of view of those interested in sanatorium treatment, is that of the "*Arrested*" cases. As it must be allowed that only one-fifth of the total number of patients treated really recovered,

a brilliant success cannot be claimed.

Group IV., those patients showing no change for better or worse, is largely made up of the chronic type, for whom sanatorium treatment does next to nothing. These patients may be able to work continuously for a week or two, but are very rarely self-supporting.

TABLE II.

Showing the Effect of a Positive and Negative Sputum on Admission.

	Number of Cases.	PERCENTAGE RESULT.					
		Improved.	Decidedly Improved.	Arrest.	No Change.	Worse.	Dead.
Positive cases	264	22.72	21.59	8.71	24.62	16.31	5.68
Negative cases	127	5.51	27.24	37.79	26.53	2.40	1.57*

* One case died of syncope and the other of acute miliary tuberculosis with no sputum.

Those patients whose sputum contained tubercle bacilli on admission numbered 264, while those in whose sputum no tubercle could be found, even after many examinations, numbered 127. As will be seen from the above table, the percentage of arrests in patients without tubercle bacilli is fairly high, viz., 37.79 per cent., while the number of these patients who have become worse in spite of treatment is very small—2.40 per cent. It is only fair to state that, while two cases showing negative sputum died, they were both exceptional, one dying from syncope and the other from acute miliary tuberculosis.

Another point worth noticing in Table II. is the large percentage of cases with a negative sputum which show "Decided Improvement." Had the patients been able and willing to remain longer under treatment, a very considerable number of them would have passed into the "Arrest" column.

We find also a large percentage of cases who are classed as "No Change." This group consists chiefly of patients who only remained under treatment for a short time, because they felt so well that they could not resist the temptation of high wages and war bonuses. It is a great pity that such

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disease arrested. Can anything show more clearly the clamant need for the early diagnosis and treatment of every case of pulmonary tubercle?

It should be borne in mind that, in all cases in the early stage of infection, the disease is probably limited to one lobe. This is the time for efficient treatment, and only when such cases form the bulk of the patients in sanatoria will the results be worth the labour and expense to the State.

TABLE IV.

Showing the Effect of the Occurrence of Excavation on Admission.

	Number of Cases.	PERCENTAGE RESULT.					
		Im- proved.	Decided- ly Im- proved.	Arrest.	No Change.	Worse.	Dead.
No excavation	310	16.77	23.54	22.25	22.90	9.35	1.93
Excavation -	81	18.39	9.87	2.46	34.56	20.98	14.81

In this table the cases are classified according to whether excavation was present or not on admission, and the results of treatment have been compared.

The number of cases which showed the presence of excavation in one or more lobes was 81, while those in which no signs of excavation could be found numbered 310. In the latter group, the patients who left with the disease "arrested" numbered 69, which gives a percentage of 22.25, whilst, in the former group, only 2 patients were discharged as "arrested" cases. This gives a percentage of only 2.46, which proves conclusively the bad effect exerted by the presence of excavation on the prognosis of the individual case. Excavation only occurs in a late stage of the disease; hence this table again shows the necessity for early diagnosis and treatment.

Another point which this table brings out is the very largely increased death-rate in those cases in which excavation is found. This is probably due to the intractable toxæmia which is so often associated with excavation. The question whether this is caused by the tubercle bacillus alone or by a mixed infection with septic organisms appears to be still *sub judice*.

The following table shows the effect of complications on the

patients could not have been prevailed upon to remain longer under treatment, for a considerable proportion of these would also have passed into the "Arrest" column.

The figures in Table II. show very clearly the great advantage to be gained when cases of pulmonary tuberculosis are diagnosed before tubercle bacilli are found in the sputum, for the presence of bacilli is undoubtedly a sign of advanced disease.

TABLE III.

Showing the Effect of the Extent of the Pulmonary Lesion.

	Number of Cases.	PERCENTAGE RESULT.					
		Im- proved.	Decided- ly Im- proved.	Arrest.	No Change.	Worse.	Dead.
1 Lobe -	77	6.49	20.78	55.84	14.28	1.30	1.30
2 Lobes -	178	20.78	25.84	13.48	29.77	7.86	2.24
3 " -	69	20.29	32.00	5.80	21.73	17.39	2.89
4 " -	67	16.41	10.44	0.00	29.85	28.35	14.92

This table shows the whole of the cases divided into groups according as to whether one, two, three or four lobes of the lungs were found to be affected on admission. No case on admission was found to have all five lobes affected.

This classification, founded on an anatomical basis, has been selected in preference to the more commonly used classification of Turban. In the opinion of the writer, the great objection to Turban's classification is that the personal equation is too prominent and it varies with different observers.

If we consider "Arrest" as the best result obtainable, and apply it as a test to our own statistics, what do we find in Table III.? The findings are these. When only one lobe of one lung is affected, it is found that more than half the patients left the sanatorium with the disease arrested. There is an enormous drop in the percentage of arrested cases when the patients are admitted with two lobes affected, while, in those who have three lobes affected, the percentage is still smaller. Lastly, of those unfortunate patients who first came under treatment with four lobes involved, not a single one left the sanatorium with the

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The following table shows the effect of complications on the

course of the disease. In all, 79 patients had one or other of these complications, and it is worthy of note that out of these 79 cases, only 3 left the sanatorium with the disease arrested, while 13 died.

TABLE V.
Showing the Effect of Complications.

Complication.	Number of Cases.	ACTUAL RESULT.					
		Im- proved.	Decided- ly Im- proved.	Arrest.	No Change.	Worse.	Dead.
Pleurisy -	25	6	3	2	7	4	3
Tuberculous laryngitis -	15	2	2	0	5	5	1
Hæmorrhage	11	1	5	1	0	2	2
Albuminuria -	9	1	0	0	5	2	1
Tuberculous Glands -	8	0	2	0	1	4	1
Tuberculous Peritonitis -	6	1	0	0	1	1	3
Glycosuria -	3	1	0	0	0	2	0
Pneumothorax	1	0	0	0	0	0	1
Tuberculous Meningitis -	1	0	0	0	0	0	1
Totals -	79	12	12	3	19	20	13

From a study of the table above, it would appear that the presence of tuberculous peritonitis as a complication has a profoundly adverse effect on the lung condition. This is not what one would expect, for tuberculous peritonitis is, in itself, one of the less serious forms of tuberculosis. Albuminuria seems also to be a grave complication, while tuberculous laryngitis does not appear to be quite so serious.

As is well known, neither pneumothorax nor tuberculous meningitis occur as a complication except near the end of a serious illness, and, as a result, such cases generally have a fatal termination.

TABLE VI.
Showing the Grade of Exercise Reached.

Confined to bed	-	-	-	-	64
Rest outside	-	-	-	-	24
Total rest cases	-	-	-	-	88

Stroll	-	-	-	-	-	22
Walk I.	-	-	-	-	-	56
„ II.	-	-	-	-	-	43
„ III.	-	-	-	-	-	33
						<hr/>
Total walking cases	-	-	-	-	-	154
						<hr/>
Work I.	-	-	-	-	-	51
„ II.	-	-	-	-	-	47
„ III.	-	-	-	-	-	51
						<hr/>
Total working cases	-	-	-	-	-	149
						<hr/>

This table shows the number of patients who reached the various grades of walk or work. Sixty-four patients were confined to bed during the whole of their stay in the sanatorium. Twenty-four were only able to get up for a part of each day and sit outside. Twenty-two patients were able to take a stroll of $\frac{1}{2}$ a mile twice a day. Fifty-six patients were able to walk $1\frac{1}{4}$ miles twice a day, while 43 were able to walk $2\frac{1}{2}$ miles twice a day on the level. Only 33 were able to walk 2 miles uphill twice daily.

From the above it will be seen that 88 patients were never fit to walk at all, and had to be kept at rest, while 154 were able to walk from $2\frac{1}{2}$ miles on the level to 4 miles uphill per diem, but were not fit for work. Those patients who were able to work numbered 149, and, of these, 51 were never equal to more than light work, while 47 were able to do medium work, and 51 could do hard gardening work. The working hours each day did not exceed four and a half, and were divided so that the men worked for two and a half hours in the morning and two hours in the afternoon.

TABLE VII.

Showing Duration of Stay.

Up to 1 month	-	-	-	-	77
1 to 2 months	-	-	-	-	71
2 „ 3	-	-	-	-	69
3 „ 4	-	-	-	-	123
4 „ 5	-	-	-	-	29
5 „ 6	-	-	-	-	7
Over 6	-	-	-	-	15

This table shows the duration of treatment. Seventy-seven patients stayed less than one month, 71 between one

and two months, 69 from two to three months, while those who remained from three to four months numbered 123. Comparatively few, viz., 51, stayed over four months. Less than three months' treatment is useless, and yet 217 patients left before that time. When patients remain such a short time, no permanent improvement can be expected to take place. In the case of patients who only stay for a few weeks, no difference can be detected in the physical signs.

In pulmonary tuberculosis, the onset is the great hindrance to the early treatment of the disease. It would save many lives if every case in the earliest stages began by a smart hæmoptysis, sufficient to impress the patient with the necessity for placing himself immediately under medical supervision. In a very large percentage of cases, the onset is insidious; neither the patient nor the doctor can say exactly when the disease began. In some cases, it is thought to follow a cold in the head or an attack of so-called influenza, and, if it begins with pleurisy, it is generally thought to be the result of a chill, while all the time it is the result of the tubercle bacillus. In another type of case, the patient may complain of inability to work, associated with irritability of temper; he is worried by trifles which previously he would have ignored. These cases are often classed and treated as neurasthenics, and only the after-history of the case disproves the original diagnosis. Very closely allied to this type is the patient who complains of digestive trouble, most commonly, in the experience of the writer, of pain over the epigastrium coming on one to two hours after a meal and associated with flatulence. This condition persists in spite of treatment. In these cases, little or nothing can be made out on physical examination, and often the condition is looked upon as functional when it is really toxic. An even more common mode of onset is the combination of some anæmia with loss of appetite and weight, cough only showing itself at a later date. Thus it must be admitted that no definite set of symptoms can be said to be pathognomonic of early pulmonary tubercle, and, as a result, early diagnosis is often a matter of extreme difficulty. To wait till sputum appears, and, with it, tubercle bacilli, is seriously to lessen the patient's chance of recovery.

Among industrial patients who are married and have a family to support, it is generally found that the wage earner

will go on working as long as he can possibly get about, and will not consult a doctor until the last moment. There never was a more shortsighted policy than this, for it prevents the possibility of treatment in the early stages, when treatment is most successful and the good results most likely to be permanent. Moreover, the loss to the State is infinitely greater owing to the longer time required for treatment and the frequently impaired working capacity.

It is quite impossible for the medical man in a busy practice to carry out the finer methods required for early diagnosis, and he should have some place to which he could send doubtful cases for examination. At present, tuberculosis dispensaries are the only places existing for this purpose, but, in the writer's experience, the means of early diagnosis available at the majority of such dispensaries are very poor, little better, indeed, than are at the command of the general practitioner. Tuberculosis dispensaries ought to be fully equipped, and, where necessary, should have beds where patients could be kept under observation for a few days. The examination of contacts is a very important and exacting part of the work of a dispensary, and a part which cannot be done too thoroughly, every known means being used to make a positive or negative diagnosis.

The financial aspect is one which presents great difficulties, for, to work out each case of suspected pulmonary tuberculosis thoroughly, the services of serologists and bacteriologists, as well as of specially trained clinicians, are necessary, and the amount of work which one man can put through in a day is, by the nature of it, strictly limited.

Consumptive patients cannot be treated by the dozen, and, even in early cases, individual attention is necessary. It must not be thought that any sanatorium will do for a tuberculous patient without regard to his general condition and personal idiosyncrasies.

Where possible, careful choice of a *suitable* sanatorium should be made, for in some cases, it may be found that the climate is too relaxing, with the result that appetite fails, or the air may be too bracing, with the result that the patient suffers from sleeplessness, or cold winds may be prevalent, and aggravate a bronchitis.

In the majority of cases of pulmonary tuberculosis, the disease runs a chronic course, and, therefore, requires pro-

and two months, 69 from two to three months, while those who remained from three to four months numbered 123. Comparatively few, viz., 51, stayed over four months. Less than three months' treatment is useless, and yet 217 patients left before that time. When patients remain such a short time, no permanent improvement can be expected to take place. In the case of patients who only stay for a few weeks, no difference can be detected in the physical signs.

In pulmonary tuberculosis, the onset is the great hindrance to the early treatment of the disease. It would save many lives if every case in the earliest stages began by a smart hæmoptysis, sufficient to impress the patient with the necessity for placing himself immediately under medical supervision. In a very large percentage of cases, the onset is insidious; neither the patient nor the doctor can say exactly when the disease began. In some cases, it is thought to follow a cold in the head or an attack of so-called influenza, and, if it begins with pleurisy, it is generally thought to be the result of a chill, while all the time it is the result of the tubercle bacillus. In another type of case, the patient may complain of inability to work, associated with irritability of temper; he is worried by trifles which previously he would have ignored. These cases are often classed and treated as neurasthenics, and only the after-history of the case disproves the original diagnosis. Very closely allied to this type is the patient who complains of digestive trouble, most commonly, in the experience of the writer, of pain over the epigastrium coming on one to two hours after a meal and associated with flatulence. This condition persists in spite of treatment. In these cases, little or nothing can be made out on physical examination, and often the condition is looked upon as functional when it is really toxic. An even more common mode of onset is the combination of some anæmia with loss of appetite and weight, cough only showing itself at a later date. Thus it must be admitted that no definite set of symptoms can be said to be pathognomonic of early pulmonary tubercle, and, as a result, early diagnosis is often a matter of extreme difficulty. To wait till sputum appears, and, with it, tubercle bacilli, is seriously to lessen the patient's chance of recovery.

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longed treatment. This being so, it is necessary for patients to remain in a sanatorium for a period varying from four months upwards. Some Insurance Committees and others fix an arbitrary time limit for sanatorium treatment; this is a great mistake, for the length of time necessary for different patients varies greatly, some being fit for work at the end of four months, while others will require six months, a year, or even longer. It is better to turn out a small number of recoveries than a large number of patients who break down again after working for a few weeks.

When a certain well-known statesman, advocating the advantages of the Insurance Act, promised tuberculous patients treatment "under first-class hotel conditions," he made a grave error in the choice of his phrase, which should have run, "under first-class hospital conditions." The majority of patients arrive at a sanatorium with the idea that they have been sent for a holiday in the country, for which they will not have to pay, and during which they will be free to do as they please. There was never a more mistaken idea, for everyone who is afflicted with consumption is faced with the hardest piece of work he has ever tackled in the effort to regain his health, and, during the time of his treatment, he will have to conform to rules, the use of which he does not understand, and which he considers arbitrary and unnecessary. This attitude of mind is most prevalent among industrial patients; and has a very profound effect on the results of treatment. It is well known that the patient who faithfully carries out his instructions in the spirit as well as in the letter is he who, humanly speaking, will make the best recovery.

The lack of education of many of the industrial class is a serious drawback in their treatment, for they are often unable to grasp, even after full explanation, the reasons why it is necessary for them to give themselves heart and soul to the task of getting well.

The necessary curtailment of patients' liberty while in a sanatorium is a difficult problem to deal with, and has a very important effect on the results obtained. Patients, as a whole, do not like to have to obey orders, and this is especially true of the industrial patient! Very few are able to grasp the fact that the essential part of sanatorium

treatment is the prescription of carefully regulated rest and exercise. It is difficult to get the popular mind away from the idea that a bottle of medicine will cure all ills. It is only by careful attention to the details of a properly planned *régime* that good results can be obtained, and then only with the intelligent co-operation of the patient. Unfortunately, the tendency of the majority is to look upon the sanatorium officials as their gaolers instead of their helpers. Until patients have been educated up to the point where they realize what sanatorium treatment means, this attitude is likely to prove a very real hindrance.

It was believed that all the allowances due under the Insurance Act to patients undergoing sanatorium treatment who have no dependents, and who, therefore, do not receive any insurance money, was to be placed to the credit of a fund to provide health lectures for the people. In no instance can the writer hear of this having been done. As a result, the work of the sanatorium is doubled, for the patients have to be educated before they can be successfully treated.

In all cases of pulmonary tuberculosis, there is a distinct mental side, and while this is more pronounced when there is toxæmia, it is found, to a greater or less extent, in all patients. This condition is another hindrance to treatment. It is usually said that tuberculous patients have an optimistic turn of mind, as, for example, the well-known "*Spes Phthisica*." This has not been the experience of the writer, who has more commonly found irritability of temper, fractiousness, or occasionally a slight melancholia.

Another factor which does not tend to good results is the disgraceful state of the teeth of many patients on admission. It appears that the Insurance Act provides no help except in the way of extractions and a few small stoppings. What, then, is to be done in the case of a patient the whole or part of whose mouth has to be cleared of suppurating stumps? If he has the teeth extracted, and is too poor to pay for an artificial set, his last state is nearly as bad as the first. In the writer's experience, from 50 to 75 per cent. of patients on admission require the services of a skilled dentist. The importance of attention to patients' teeth is not fully realized by the Committees who are

responsible for sending patients to sanatoria. To a medical man, it is plain that if a patient has bad teeth, he cannot masticate his food properly, and is, therefore, liable to suffer from digestive troubles, which are intensified if, at the same time, he is absorbing all the products of an extensive alveolar suppuration. The remedy for this state of affairs is obvious.

In most industrial sanatoria, the patients are given work to do. This is now considered an essential part of treatment, but few realize this, and many try to shirk the work or leave as soon as it is prescribed for them. On the other hand, some feel so much better after a few weeks' treatment that they decide to leave, imagining that they are fit to follow their usual occupations. At present, the high wages and war bonuses are, no doubt, a great temptation, but, at the same time, with many it is sheer lack of perseverance that prevents their carrying out the treatment to its termination. The only method of dealing with this is to refuse treatment to any patient who will not guarantee to remain a reasonable time in the sanatorium.

When a patient is finally discharged from the sanatorium, what is he to do? Force of circumstances often compels him to return to his old employment and his unsatisfactory method of living; as a consequence, his disease again becomes active, and further treatment is required, which never gives such a satisfactory result as in the first instance. The necessity for establishing some organization to help ex-sanatorium patients to find suitable employment will have to be considered in the near future. A good deal has been done in isolated instances, but no comprehensive scheme has yet been put forward. This subject bristles with difficulties, most of which centre round the patient's fitness for work and the wages demanded. The difficulties are increased in the case of the married man with a family, for it is not always possible to transport the whole household to the country, although, in many cases, it would be greatly to their advantage. Intimately bound up with the after-care of the consumptive is the housing question, which cannot be discussed here.

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in children are followed by the development of a pulmonary lesion after a longer or shorter time. It is, therefore, essential that these cases should be thoroughly treated as soon as discovered in the course of medical school inspection.

The time may not be ripe for introducing legislation by which a patient suffering from pulmonary tubercle would be compelled to place himself under treatment, but, if this disease is to be stamped out, some such step will have to be taken. At present, the obtaining of a sheriff's warrant for the removal of a patient is difficult, and is likely to do more harm than good, by making infected persons residing in that area conceal the fact that they are suffering from the same disease.

A prevalent idea appears to be that the longer a patient is kept in a sanatorium the better will be the result, and that is undoubtedly the case up to a certain point, but that point is reached when the patient begins to go "stale," as everyone will who has to live under somewhat monotonous conditions for months at a time. At present, the only method of combating this is to send the patient home for a week or two. This entails many disadvantages, and very often the patient comes back with his lungs in a worse condition than when he went out, and he may have to begin again at a lower grade of exercise than that at which he was when he left. Change of scene is, in many cases, a necessity, and if all industrial sanatoria could have their regulations, regimen, and dietaries standardized, it would then be possible to transfer patients without any great change in the methods of treatment. This would provide a means of dealing with "staleness," and would also have the advantage that patients being transferred from one sanatorium to another would not have cause for complaint that the *régime* of the second was too strict, and that they wished a re-transfer to the first.

The only conclusion that can be arrived at is, that, until the difficulties outlined in this paper are boldly faced, investigated, and tackled by the authorities, the results of sanatorium treatment will remain poor, and a large amount of public money will be frittered away.



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would probably find one-half of the medicines ordered ineffective, and at least one-third admittedly futile. The former category largely consists of examples of the *post hoc, propter hoc* fallacy; the latter comprises the pusillanimous "Placebo."

Writing as one who has had in the past a not inconsiderable experience of general practice, I should say that a fair proportion of the "walking and cot" cases—to use the language of the moment—met with in private, presents one with vague and indefinite, or frequently trivial, symptoms which cannot be precisely pigeon-holed, but are commonly referred to as "liver," "run down," "acidity," "below par," etc. The patient dotes on a diagnosis and pines for a prescription, wherefore the doctor prepares a label and a "Placebo"—*et tout va bien*. Why, then, should anybody grumble? Because the diagnosis is often slipshod, and the treatment always unscientific; the one lends itself to the other.

Granted that the diagnosis is not easy, not clear, indeed often not possible in the first instance, surely that is a very good reason in itself for not prescribing a "Placebo," for drugs may do harm as well as good, save in those cases in which the "Placebo" appears in its most contemptible and indolent form, containing merely coloured and flavoured aquæ, more or less puræ. The truth is that the medical man is daily confronted with an array of slight functional ailments, due to an unhealthy mentality or a narrowed point of view, and the treatment which should face the cause squarely, and deal with it on rational lines, is lured on readily, as if by some magnetic attraction, into the presence of that goddess of ease and indolence, whose insignia bear the strange device: "I will please." And the end is attained—the patient is pleased and the patient gets well; the physician has pulled the strings and the figure works to the music of the old classical melody: "*Populus vult decipi, ergo decipiatur.*"

Prof. Sahli is reputed to have said: "If I were very ill I would rather be treated by a homœopath, who would give me nothing, than by an allopath imbued with a sense of his therapeutic power."

The public is over-drugged. It is drugged when it is

"PLACEBO": A PROTEST AND A PLEA.

BY STANLEY NOBLE, M.D., TEMP. CAPT. R.A.M.C.

*Physician to the British Hospital for Mental Disorders and
Nervous Diseases.*

AN old teacher of mine used to say: "Gentlemen, there are two drugs in the Pharmacopœia of some service; one is mag. sulph., to open the bowels, and the other, tinct. opii., to shut them up again, and you may throw in a little mercury, if you like." True, he was a surgeon, and lived before the days of serum vaccine and organo-therapies; nevertheless, most practitioners will admit a considerable substratum of truth in this *façon de parler*. Similarly suggestive was the advice of the wise physician who warned the young and book-learned tyro, whilst speaking of a certain fashionable drug: "Hurry up, my boy, and prescribe this remedy while it is doing good."

It is not my concern nor my desire to belittle the undoubted value of appropriate drugs as aids to treatment, or, indeed, as a main treatment in a large number of cases. On the contrary, taking a hill-top view, one realizes how much suffering humanity owes to the laboratory chemist and to intelligent drug-therapy. But it is my purpose to enter a protest against the employment of drugs in every ailment and every disease one is called upon to treat, and especially to damn, and without any faint praise, that hoary old expedient, the "Placebo"—ponderously advised aforetime in the older and out-of-date text-books, without any saving spice of humour, as a superlative remedial agent, but nowadays less reverently alluded to—though not in print—as "Mist. G.O.K.," or "Mist. A.D.T."

But what do we mean by a drug? What is it to include? For my present purpose, let it cover that stock of liquids, pills, and powders that are to be found in an ordinary chemist's shop or in the surgery of a medical practitioner who dispenses his own medicines.

I will dare to say that if one were to analyse the daily list of the patients of the average busy practitioner, one

definitely be granted that the end is attained, and that the "Placebo" cures; yet we know that, by a pious fraud, we have roused the curative idea in the mind of the patient, and the *vis medicatrix naturæ* is set to work. Dubois says: "The nervous patient is on the path to recovery as soon as he has the conviction that he is going to be cured; he is cured on the day he believes himself cured." Recognizing, then—as all enlightened people do in these days—the existence of suggested and auto-suggested ideas as potent forces, why should we not proceed to call them into action by the direct method straight away, educating our patients to their value, and indicating how they are to be made use of? Instead of this, we are content to navigate the ship like a landlubber; we steer a course out into mid-ocean, and the frail vessel grinds and strains 'mid heavy seas, whilst the trained sailorman would be hugging the shore in comfort and fair weather, and making port in half the time and with half the fuel. Thus, we prescribe "Placebos" and "nerve tonics" galore; we order the latest "brain food" or an electric bath; we suggest an expensive nursing home and some vibratory massage; we announce a change of air and advertise a continental health resort; or we may even hint darkly at a surgical operation. In a word, we do everything to self-centre the patient and confirm his disease, rather than teach him the value of will-power, optimism, self-confidence, and persistent intention.

A critic of Prof. Walsh's book on "Psychotherapy" writes: "Psychotherapy alone, except in certain well-defined cases of nerve disorder, can do little or nothing." Nevertheless, most people will agree that faith may move mountains, soothe pain, lessen inflammation, and inspire the hope that generates a feeling of well-being. Are such things "little or nothing"? Because faith—otherwise suggestion or auto-suggestion—cannot remove a cancer, is it "little or nothing" that it can oftentimes mitigate suffering, increase body-weight, and prolong life even in the cancered sufferer? Admitted that drugs and other physical expedients may do these things in such cases, is there any good reason why they should be preferred, *cæteris paribus*, and is the fact a reason for disparaging the value of psychic means?

Another critic has said: "In all but a small corner of

sick; it is drugged even when it is well. Each meal is surrounded by physic, so that the supposed *materies morbi* shall not escape destruction anywhere. There is a concoction for everything, and the "Placebo" is to be had for the asking. The mob have taken over the medicine-chest.

I know a wealthy valetudinarian, whose whole day used to be ticked off in time-table fashion with a view to assisting the action of almost every organ in what really was a robust body. There was the inevitable aperient; there was an "anti-gout" water; there was a mixture before, and a tabloid with meals; there was a "nerve tonic" twice a day, a cardiac stimulant *si opus sit*, and a cachet at bedtime—all running riot in one and the same day. In addition, she enjoyed the services of a masseuse (her saviour), and visited constantly an establishment that provided some form of electric treatment. She was dieted for gout and rheumatism by a well-known continental Hun, had a large appetite and a desire to reduce *avoirdupois*. Her prescriptions were multiform and mysterious, her medical advisers more so; she was the type that demanded the "Placebo," and so her chemist flourished in the land. *Mais nous avons changé tout cela*; he doesn't now, I fear, from this source.

Munro, in his book on "Suggestive Therapeutics," narrates the case of a man morbidly self-conscious of some functional disturbance, who wandered from one physician to another without relief, until at last he struck a doctor who looked him squarely in the face and said: "My friend, go home, read the book of St. James, call yourself a damned fool, and leave doctors alone." Crude advice, perhaps, but effectual, and capable of appropriate modification by the tactful observer.

Nevertheless, the "Placebo" holds the field, and the doctor is the acclaimed healer by its means. "Let something be done, or at least seem to be done." The result is always a medicine, and frequently a "Placebo." Is it intelligent to prescribe a "Placebo"? Is it honest to one's self? Is it scientifically sound? If not, then why do we do it? There may be several reasons, but the main one is contained in the translation of the word, and is an unnecessary fraud on the patient and a blot upon our intelligence. For let it

definitely be granted that the end is attained, and that the "Placebo" cures; yet we know that, by a pious fraud, we have roused the curative idea in the mind of the patient, and the *vis medicatrix naturæ* is set to work. Dubois says: "The nervous patient is on the path to recovery as soon as he has the conviction that he is going to be cured; he is cured on the day he believes himself cured." Recognizing, then—as all enlightened people do in these days—the existence of suggested and auto-suggested ideas as potent forces, why should we not proceed to call them into action by the direct method straight away, educating our patients to their value, and indicating how they are to be made use of? Instead of this, we are content to navigate the ship like a landlubber; we steer a course out into mid-ocean, and the frail vessel grinds and strains 'mid heavy seas, whilst the trained sailorman would be hugging the shore in comfort and fair weather, and making port in half the time and with half the fuel. Thus, we prescribe "Placebos" and "nerve tonics" galore; we order the latest "brain food" or an electric bath; we suggest an expensive nursing home and some vibratory massage; we announce a change of air and advertise a continental health resort; or we may even hint darkly at a surgical operation. In a word, we do everything to self-centre the patient and confirm his disease, rather than teach him the value of will-power, optimism, self-confidence, and persistent intention.

A critic of Prof. Walsh's book on "Psychotherapy" writes: "Psychotherapy alone, except in certain well-defined cases of nerve disorder, can do little or nothing." Nevertheless, most people will agree that faith may move mountains, soothe pain, lessen inflammation, and inspire the hope that generates a feeling of well-being. Are such things "little or nothing"? Because faith—otherwise suggestion or auto-suggestion—cannot remove a cancer, is it "little or nothing" that it can oftentimes mitigate suffering, increase body-weight, and prolong life even in the cancered sufferer? Admitted that drugs and other physical expedients may do these things in such cases, is there any good reason why they should be preferred, *cæteris paribus*, and is the fact a reason for disparaging the value of psychic means?

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sick; it is drugged even when it is well. Each meal is surrounded by physic, so that the supposed *materies morbi* shall not escape destruction anywhere. There is a concoction for everything, and the "Placebo" is to be had for the asking. The mob have taken over the medicine-chest.

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experience of the busy practitioner. The first is an organic disease we know to be incurable. We cannot reconstruct the nerve tracts that have been destroyed, but we can treat the patient himself, and alleviate the neurasthenia engendered by the disease, with the aid of psychotherapy. The second is a common functional condition, to be combated only by psychic methods. Again, take a third case; say an ordinary pneumonia. Here is an organic disease which is very likely going to kill the patient, unless his own mental state and surrounding mental influences are favourable. Every cell in the organism has got to function at its highest until the crisis is over, and the issue may very well depend upon the capacity of the physician and the nurse to maintain a high degree of psychic function. The Lascar lies down and dies when he makes up his mind to, and no physician can help him; the pneumonia patient may be allowed to do the same.

Moral is a thing of vast importance to the soldier fighting on the field of battle; it is equally important to the patient fighting in the territory of disease. If this be true, then one can make out a strong case for the value and usefulness of psychotherapy in organic affections as well as in the so-called functional disorders, and the "small corner in the vast and dark territory of disease" becomes an immense tract of fruitful and fertile promise.

Let me conclude, as I began, by asserting that the Pharmacopœia, intelligently used, is indispensable in the successful treatment of many ills—opium to relieve pain iron to cure chlorosis, bromide to allay cortical irritability. and so on—but drugs, for all and sundry cases, is indefensible, and the "Placebo" a pestilential proposition.

the vast and dark territory of disease, the will-power will be found empty of solid effect." Such a statement must come rather as a shock to those of us who have devoted our energies to the psychic as well as the physical treatment of disease. I venture to say that a critical examination of the patients seen by the average practitioner from day to day would reveal the fact that at least one-third of the cases demanded treatment by psychotherapeutic methods alone, whilst the remainder would be benefited by them. If "Placebo" prescriptions and "Placebo" bottles of medicine were to become unfashionable, there is little doubt that the dispensing chemist and the doctor who dispenses would find their work materially curtailed. It means, of course, educating the public to the efficacy and value (to say nothing of the economy) of psychotherapy and to the distinctly restricted field of drug-therapy. Along these lines, I believe we should accomplish much more towards the suppression of quack nostrums and "systems of cure" than by any legislation.

The so-called "small corner" of disease in which psychotherapy is allowed to be of some slight service is, in reality, a very large proportion of the whole area—at least, to the general practitioner. He it is who, from the clinical physician, becomes the guide, philosopher, and friend of his patients, and, in virtue of this position, his employment of psychic methods as a sole treatment, or as an adjunct to treatment, must be varied, extensive, and important.

Take a case of *tabes dorsalis*, originally diagnosed and discussed amid the oft-times tragic atmosphere of the outpatient department of a hospital. This man hears his symptoms debated, his past investigated, and his future settled. Certainly everything is done as guardedly as may be, but it is not possible to check the havoc of suggested or auto-suggested ideas, and can we wonder if such a patient subsequently develops a train of neurasthenic symptoms, which render his life a burden, while the actual organic disease for all present practical purposes is a comparatively negligible quantity? Or, say the patient is a victim of some morbid obsession which threatens to derange his mind. In both instances, the treatment indicated is of a psychic character, and such cases are common enough in the daily

were attended by especial success. In all, I treated twenty-six cases of "cut tendon" in this situation, and in only two, both of which were unfortunately complicated by suppuration, were there any signs of either mallet finger or an impaired extensor function.

In following the treatment for accidental division of tendon without actual suture, it is essential that four important details should all be present at one and the same time; if any one of these details is absent, I acknowledge that it is decidedly risky to give a really hopeful prognosis either with or without actual suture.

1. It is of the utmost importance that the injured finger should be maintained in a position of hyperextension for at least three weeks. This position should be brought about both at the metacarpophalangeal joint and again, if possible, at the ungual inter-phalangeal joint. The method I usually adopt to effect this position is by means of a simple flexible aluminium splint applied, for preference, to the palmar aspect of the hand and finger. In practice, I find that it is most convenient to fix the splint by means of two pieces of Mead's strapping, one of which I carry round the palm of the hand together with the splint, and the second piece round the splint and middle phalanx. By a little manipulation of the splint, before fixing it in position, it is possible in most cases to accomplish a right-angled hyperextension at the metacarpophalangeal joint with little or no discomfort to the patient. The ungual phalanx can now be generally slightly hyperextended by placing a pad of cotton wool between the pulp of the finger and the splint.

2. It is necessary that the actual skin cut should have fairly close approximation of its edges, or, at least, the laceration must not be too extensive to render good apposition possible by means of skin stitches only. As a general rule, one finds that the position of the finger, being in hyperextension, greatly relieves any tension on skin sutures, and, in fact, frequently abolishes this slight increase in the risk of

TENDON REPAIR WITHOUT ACTUAL SUTURE.

By W. FLETCHER STIELL, M.R.C.S.

Senior House Surgeon, County Hospital, Lincoln.

At one time or another, the majority of medical men meet with complexities which are, perhaps, frequently of little practical importance, but for which there is often no very obvious explanation. A short while back, whilst performing multiple tenotomies for a case of anterior poliomyelitis with deformities, a point occurred to me which, as far as I remember, I have never seen explained in any literature. "Why does a tendon, when severed by trauma arising in the course of one's everyday employment, invariably fail to heal without suture? Whereas, if it has been divided deliberately by the surgeon's tenotome, it invariably undergoes firm union in the course of about six to eight weeks." It was this small complexity which made me think that perhaps, after all, we are much too keen on employing immediate suture in cases of "cut tendon."

Consequently, I collected a number of cases of accidental division of tendon, and treated them, wherever possible, on similar lines to those employed in the after-treatment of surgical tenotomy. I confess that I confined my efforts entirely to the extensor tendons of the fingers and thumb, which, after all, are those which are most exposed to injury, simply because I did not care to take the risk of experimenting on tendons which, in the event of failure, would have caused a really serious disability. As the results of the line of treatment that I followed were, in every case, a complete success, I think it may prove of some practical value to practitioners, especially to those who practice in districts remote from general hospitals or whose surgical facilities are limited, to record a rough outline of the technique employed, and the type of case which is at once amenable to treatment by this method. First and foremost, it was with cuts inflicted on the extensor tendons anywhere between the dorsal expansion and the insertion of the tendon into the base of the ungual phalanx, that my efforts

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a very considerable amount of growth does take place, especially from the proximal end, but the separation is so great—generally at least $2\frac{1}{2}$ in. in the adult—that repair is prolonged to such an extent that it becomes impossible for the tendon sheath to retain its normal histological structure and its physiological function. Its walls become replaced entirely by white fibrous tissue, the synovial glands undergo complete atrophy, synovia is no longer secreted, and the remnants of the tendon sheath ultimately fuse across the cavity, down which the tendon would have to grow; all these facts exterminate all effort on Nature's part at bringing about a successful tendo-junction. The question that naturally enough will arise is, What would happen if we were to perform a tenotomy proximal to the dorsal expansion? Should we find a similar failure on Nature's part to bring about a successful union? Personally, I have had neither the necessity nor the opportunity to perform a tenotomy on the extensors of the fingers, and, as far as I know, this is a tendon which seldom requires tenotomy, but I rather think that, if this was at all a common operation, one would find a very high percentage of unsuccessful results. When we consider the vast number of tendons that are divided wilfully by the surgeon's knife in the performance of tenotomy, it is really wonderful that there is not a larger number of non-union results. There is one tendon, however, the extensor longus hallucis, which is frequently divided for such deformities as paralytic talipes calcaneus valgus, or paralytic pes cavus, which does occasionally fail to unite, and here again is an example of tendon division followed by excessive separation of the cut ends and a consequent failure at reunion.

Now, as regards the great importance of having close apposition of the skin edges, in order that we may expect primary union of a tendon, divided by trauma, when it is treated by the non-suture method. I have already mentioned the fact, that the great importance of this point is to maintain an adequate blood-clot between the ends of the tendon, which is perhaps the most essential element of all in tendon repair. This close apposition and consequent blood-clot is always present as a result of surgical tenotomy, and it is on account of this that, whenever

sepsis entirely.

3. It is inadvisable to employ any form of drainage whatever for two reasons: firstly, because it tends to remove the very necessary and beneficial blood-clot from between the ends of the divided tendon; and secondly, that it only provides one more possible entrance for micro-organisms. If there are early signs of suppuration when the patient first comes under treatment, or even if the wound becomes infected at a later date, then drainage becomes truly necessary. If this unfortunate complication does arise, the final functional result of the treatment will be equally disappointing, both with or without actual suture of the tendon.

4. This is perhaps the most important factor in the treatment of "cut tendon," viz., that absolute asepsis is essential, or at least asepsis as regards the tendon sheath itself. I have frequently seen slight suppuration followed by a perfect functional result, but in these cases I am convinced that the sepsis was confined solely to the skin wound, and that the tendon sheath itself was uninvolved throughout.

If these four important points in the method of technique are strictly observed, and the tendon sheath remains aseptic, primary union will invariably occur between the divided ends of the tendon without any actual tendon suture whatever, and, for suitable injuries inflicted distal to the dorsal expansion, I prefer this line of treatment to any other for several reasons. Firstly, as I have already suggested, it is a simple method to pursue, when surgical facilities are not present; secondly, there is considerably less risk of wound infection; and thirdly, it usually results in a much better extensor function than cases in which the tendon sheath has been very considerably damaged by instrumental interference.

Naturally enough, the first question that the reader would ask is, "Why will primary union not occur when the injury is proximal to the dorsal expansion, and yet all four of the essential factors for repair are present?" As a matter of fact, after retraction of the cut ends has ceased,

should, however, this fail to produce all that is desired in the way of a good functional result, the treatment can be supplemented by daily injections of fibrolysin in Mxv doses, or, still more conveniently, by massage with fibrolysin ointment.

Before I close this article, which, as I have already pointed out, I hope may be of some practical value to practitioners not blessed with surgical facilities, I wish to describe roughly two cases of cut tendon in which I employed a somewhat original course of treatment. Both were in girls who had inflicted clean cuts across the extensor tendon about the centre of the middle phalanx—in one case, of the middle finger, and in the other, of the index finger. Both of these cases I treated by the non-suture method which I have put forward in this article. As all the essential factors were present to produce a perfect union, including perfect asepsis, I became somewhat alarmed when, after a month of careful splinting, I found there was apparently no union whatever. Perfect hyperextension had been maintained throughout, the skin wound had always been in perfect apposition, and had healed by first intention in five days; the fault then apparently arose out of the absence of the necessary blood-clot. Assuming this to be correct, I aseptically aspirated 1 c.c. of blood from the patient's median basilic vein, and immediately injected it into the position of the tendon sheath surrounding the cut tendon. My theory for doing this was to supply an artificial nidus in which the tendon could undergo repair, and, at the same time, maintain the patency of the tendon sheath. Both these cases eventually showed a satisfactory result, but whether the same would have occurred without recourse to the injections of blood, I am not in a position to state.



possible, I always prefer to perform a subcutaneous operation to the open method. The actual development of the new tendon in the organized blood-clot is interesting, although, perhaps, of slight importance from a practical standpoint. The sequence of changes is roughly as follows:—In the course of a few days the clot is permeated by ordinary granulation tissue which, in turn, is infiltrated by fibroblasts derived from the sheath of the tendon, and probably from the ends of the tendon itself. These fibroblasts eventually develop into typical tendon cells, and the fibres thus formed constitute the new tendon fibres.

In dealing with the subject of tenotomy and cut tendon complicated by suppuration, very little need be said. Sepsis following tenotomy should never, and fortunately very seldom does, arise; but if this unfortunate complication does ensue, the final result of the tenotomy is no more pleasing than that obtained in cases of suppurating "cut tendon." Sepsis of any wounded tissue always arrests repair, but, in the case of the tendon, it performs this in several ways at one and the same time. Firstly, it becomes impossible—or, more correctly, it becomes dangerous—to close the wound entirely without drainage, and thus we lose the necessary apposition of the skin wound; secondly, it is impossible to expect the formation of a normal organized blood-clot and granulation tissue between the divided ends of the tendon in a wound which is suppurating; and thirdly, even if repair should eventually take place, subsequent to the arrest of suppuration, the long-continued inflammatory process and the protracted course of the repair both tend to produce a firm fibrous union between the tendon and its sheath, whereby practically all function of the tendon becomes lost. In cases such as this, in which we have efficient tendon repair but diminished function due to adhesions—and, after all, this is undoubtedly the most common complication of cut tendon, whether treatment is of the suture or non-suture method—a great improvement may be gained by soaking the hand for half an hour daily in hot water, and then following this up by massage and passive movement. As this very simple after-treatment can, in most cases, be carried out by the patient himself, it is a very convenient method to adopt;

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CASE WITH COMMENTS.

BORIC ACID POISONING?

By GEORGE C. MAGUIRE, M.B., B.Ch., B.A.O., L.M.

Claremorris, Co. Mayo; Late House Surgeon, Tunbridge Wells, etc.

A young woman, L. M., æt: 23, was brought to the General Hospital, Tunbridge Wells, on May 13, 1915. She had stepped off a motor bus while it was in motion, and, falling to the ground, the hind wheel of the vehicle passed over her right leg.

The soft tissues of the leg were reduced to pulp, but a radiograph showed no gross injury to the bones. Some particles of grit were, however, embedded in the external malleolus, which was exposed. The leg was washed with hydrogen peroxide (vols. 5) and dressed with gauze wrung out of carbolic (1 in 40). Morphia, gr. $\frac{1}{2}$, was given for pain.

On the following afternoon, with the aid of an anæsthetic, Mr. Guthrie replaced the tissues as far as possible, and sutured the skin over the exposed area, on the outer side of the leg, making a tension incision on the posterior aspect.

Fomentations of soda chlorinata were applied four times in the twenty-four hours, and a tonic, consisting of quiniæ sulph., gr. ii, acid sulph. dil., ℥x, aquæ ad. \bar{z} i, given thrice daily.

After a few days the damaged epidermis sloughed, leaving an uncovered area from the knee to the ankle. A few necrotic patches remained, which cleared up under the sod. chlorinata fomentations. On Monday 31st, the wound showed a complete covering of healthy granulations, whereupon boric acid fomentations were substituted for the soda chlorinata.

The patient complained that evening of a slight headache, for which she had aspirin, gr. v. The headache persisted, and, as it was thought that the quinine might be the cause, its administration was stopped.

On June 2, the headache still persisted, and a macular and papular rash appeared, covering the body. The patient was very depressed, and vomited dark green fluid. On being questioned, the patient stated that she was subject to bilious attacks previous to her menstrual period, and, as her menstrual period was approaching, her condition did not arouse anxiety.

The temperature and pulse remained normal until June 3, when it rose to 99° F. and the pulse to 132. That night the patient was given calomel, gr. iii, and, being sleepless, was given pot. brom., gr. x.

On June 4, she vomited twice after mist. alba, and ecchymoses

appeared under her eyes, while her depression deepened. The temperature rose at 8 p.m. to $100\cdot2$, and her pulse became 120. The boric fomentations were then stopped. Strychnine, gr. $\frac{1}{2}$, and digitalin, gr. $\frac{1}{100}$, was given, and later, morphia, gr. $\frac{1}{2}$. The temperature rose to $101\cdot8$ and the pulse to 160.

On June 5, despite strychnine, gr. $\frac{1}{2}$, pituitrin, \mathbb{M}_{15} , and a subcutaneous saline with brandy, she died at 11:20 a.m.

A post-mortem examination showed all the organs normal except the brain, which was covered with an exudation of plastic lymph, and surface was congested.

No septic focus was found in the injured leg or in the abdomen.

The cause of death was thus left in doubt. The meningitis, though slight, might account for death, but an interesting question arose as to whether the boric acid might have caused the meningitis and thus death.

REMARKS.

An examination of the available literature shows no case of death from boric acid poisoning, but Hale White's "Materia Medica" contains the following passage under the therapeutics of boric acid:—

" . . . It may cause a scaly eruption. In exceptional cases, when applied in large quantities to raw surfaces or mucous membranes, rise of temperature, depression of spirits, feeble pulse, ecchymoses, lumbar pain, albuminuria, nausea, vomiting, and diarrhoea have supervened."

The boric acid fomentation consisted of lint wrung out of a saturated solution of boric acid.



SUBLINGUAL MEDICATION

By A. P. MURTZ, L.M.S.S.A.

FOR the last twenty years, I have extensively employed the sublingual method of medication, and I am fully in accord with what Dr. W. Paulson says in *THE PRACTITIONER*, October, 1916, concerning this method. I may add that the selection of the sublingual space is the one *par excellence* for the rapid transmission by absorption of crushed hypodermic tablets into the circulation, and patients take very readily to this mode of treatment. This is an important matter in private practice, where very fastidious patients are constantly to be reckoned with. No matter how carefully we may use the hypodermic syringe, and apart from the risk of infecting the patient, the objections to its use are numerous, practice has taught that the piston of the syringe will refuse to act unexpectedly, that the needle is blocked, the glass cracked, or the mountings have come off. I have several hypodermic syringes of the latest patterns, and keep them in an excellent condition, but I very seldom use them except by the express wish of a patient who has had injections before. A syringe will not lie idle very long before it becomes faulty, and the constant attention one has to pay to the fine wires within the needle is a serious handicap to the physician. By the sublingual method, all that I have just mentioned is negated, the exhibition of the remedy is a direct one, and no mechanism of any kind is required.

Let me now mention a few of my own cases:—

CASE 1.—A woman had swallowed about 3 oz. of acid. carbol. liquif. She had taken it secretly, and it was quite twenty-five minutes before I saw her. She was unconscious, but, from the stertorous breathing, the appearance of the face, and the smell, I had no doubt of the cause. Before proceeding with the stomach pump, I quickly administered an apomorphia tablet *sub linguam*; before I was ready with the pump, slight movements of sickness occurred, and I then washed out the stomach. The patient died, but I felt that, had I been able to apply the tablet much earlier,

effective vomiting would have occurred quickly.

CASE 2.—This case I published in the *Medical Times*. A lady patient of mine, æt. 36, contracted measles and influenza concurrently. Her symptoms were most alarming, resembling acute blood-poisoning very much. The medicine I prescribed she rejected repeatedly, and, to hypodermic injection, the patient objected. But she allowed my sublingual method willingly. I controlled the vomiting, and she was completely treated *sub linguam* by various hypodermic discs, and she slowly recovered.

CASE 3.—A case of puerperal eclampsia. During the period of gestation, slight convulsions occurred from time to time, but, when labour finally set in, the convulsions increased very much. I soon administered chloroform, and delivered quickly with the forceps. The child lived. Convulsions came on again violently, and I tried a hypodermic injection of morphine, but the prick of the needle caused such an alarming increase in the convulsions that I abandoned it at once, and administered Heroin hydrochlorate under the tongue. This was repeated from time to time, and the patient recovered.

CASE 4.—A young woman, a cretin, with extensive ulcerations of the entire body. Medicines she could not take, vomiting occurring after each dose. She was entirely treated by the sublingual method, and her skin is much improved.

I could multiply my cases very considerably, but what I have said must suffice for this publication.

I feel sure that many of my professional *confrères* must share my own opinion, especially army surgeons, who must find hypodermic medication extremely irksome when time is valuable in the field, and speed of action, and easy application of the medicaments are great essentials.

Hypodermic injections are most suitable in the case of operations for producing local anæsthesia, and now I practically use the syringe for these operations only.



PAIN CAUSED BY DILATATION OF THE DEEP
VEINS OF THE THIGHS.

By JOHN R. KEITH, M.A., M.D.

Medical Officer, Driffield Cottage Hospital.

I THINK that the following case is worth recording, for it is a typical example of a condition which does not seem to have received the attention which it merits.

Annie A., 57 years of age, about two years ago, began to be troubled with pain and swelling in the thighs. These symptoms gradually increased, being produced by walking or standing and relieved by lying down. Always absent in the morning on rising; in about an hour afterwards they invariably made their appearance, steadily becoming more pronounced as the day proceeded.

On examination, no objective signs were found to indicate the pathology of the condition, but, as speedy relief was afforded by the application of elastic support, it was evident that the symptoms arose from dilatation of the deep veins of the thighs.

Dr. T. Stacey Wilson, in his highly-interesting and valuable monograph, *The Early Diagnosis of Heart Failure, and other Essays on the Heart and Circulation*, points out that the pain is due either to pressure on the nerve trunks by the dilated veins, where they are contained in the same sheath of fascia, or to irritation of the perivascular sympathetic nerves.

With regard to treatment, the whole leg should be supported, although the thigh alone is affected with pain.

The best material is weak elastic, such as the modern crape bandage, which will, without undue pressure, give the required support to the vessel-walls and allow them to regain their normal tone, whereas too severe compression, such as is produced by rubber, will be apt to lead to a permanent weakening and thus make the support a lasting necessity. A difficulty may be found in giving proper support to the thigh owing to the tendency of the bandage to slip down. This, however, may readily be overcome by sewing the turns of the bandage (while *in situ*) together, by means of four vertical rows of stitches, and attaching a piece of tape to a belt (or corset in women, in whom the condition is generally found), as suggested by Dr. Stacey Wilson.

Practical Notes.

TREATMENT OF GOITRE BY CONTINUOUS INTESTINAL DISINFECTION.

Messerli, of Lausanne, has published a further series of 12 observations on the treatment of goitre by continuous disinfection of the intestinal tract. In all these cases, as in those previously reported, he has made use of tannoform, salol, or very frequently repeated doses of mild purgatives, keeping up the treatment for one or two months. In almost every case, an appreciable diminution in the size of the neck has quickly been produced. Some of the observations were made in Bâle, where goitre is extremely common, and where it is rare to meet a young girl without a fulness in the neck due to the thyroid. The results vary in each case, but usually it is during the second week of treatment that the greatest decrease is noticed. After from three to five weeks of treatment, the neck in most cases has become normal or very nearly so. Messerli is of opinion that the aetiology of thyroid enlargements is connected with the presence of parasites in the drinking water. He agrees with MacGarrison that antiseptics, as well as the mechanical disinfection of the intestines, act directly on the specific agent of goitre present in the intestine, or that they take effect by decreasing the germs common to the intestine, the toxic products of which may be the cause of the thyroid enlargement.—(*Revue méd. de la Suisse Rom.*, No. 12.)

DISINFECTION OF THE HANDS BY THE COMBINED USE OF HYPOCHLORITE OF MAGNESIA AND AN ANTISEPTIC VARNISH.

Dubard, of Dijon, points out that surgeons solve the problem of disinfecting their hands by wearing rubber gloves, and, at the same time, try to ensure the asepsis of the field of operation by painting on the skin a layer of tincture of iodine. Rubber gloves would never have been used, if we had a really good method of disinfecting the skin. Whatever their value, they are, at any rate, inconvenient, and they split. The real problem is, how to disinfect the surgeon's hands without injuring the skin, and keep them aseptic long enough to exclude all risk of infecting the patient during the operation. The skin, once disinfected, must be protected against re-infection by external or autogenous agents. After numerous experiments during the past five years, Dubard found that no means of simple asepsis sufficed to disinfect the skin. He then tried various antiseptics, and gave up all those which coagulate albumen—mercurial salts, tannins, alcohols, phenols, and the like. The same course was found necessary with antiseptics soluble in alcohol. If bactericidal, the concentration required for effective action was such as to ruin the skin. As a matter of fact, neither alcohol, alcohol and ether, acetone, alcohol and acid, etc., showed any active and reliable microbicidal effect.

A process of elimination left the haloid elements, Cl, Br, and I, the only available agents, and, of these, iodine was out of the question because of the many applications necessary, which resulted in skin lesions. The alkaline hypochlorites and hypobromites were hurtful to the skin by reason of their alkalinity. Finally, it was found that only a hypochlorite of an earthy metal was satisfactory. When

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used at a strength of from 1.5 to 3, or even 5, per cent., the solution of hypochlorite of magnesia, freshly obtained by the double decomposition of chlorite of lime and sulphate of magnesia, has never attacked the hands of surgeons and assistants after being used for some months. This solution has replaced Dakin's solution with complete success. The strength need not be higher than 2.5 per cent., and should not be below 1.5 per cent. Based upon these facts, Dubard has elaborated a method for completely disinfecting the hands. This consists of (1) cleaning the skin with warm boiled water, soap, and brush; (2) bathing in the antiseptic solution; (3) drying the hands and then applying the varnish.

(1) Scrubbing the hands well with a brush and soap removes the sebaceous covering which prevents the action of the antiseptic, however diffusible that may be.

(2) The antiseptic bath is a solution of hypochlorite of magnesia, from 1.5 to 2.5 per cent. in strength. The hands must be immersed for about six minutes, by which time all streptococci, staphylococci and *B. coli* will have been killed. An immersion for eight minutes kills *B. subtilis*. Before immersion, the hands must be rinsed thoroughly to remove every trace of soap.

(3) The complete disinfection of the hands having been obtained, it is now necessary to maintain this condition, and prevent the skin from getting moistened, and so affording a nidus for any sort of infective microbes. This can only be secured by covering the skin with an isolating material which is slightly antiseptic. This will keep back any bacteria from the deeper parts of the skin, and prevent soiling by any that escape from the patient. It has the further advantage of keeping in good condition a skin which has frequently to be washed, scrubbed, and disinfected, a matter of no small importance. For the varnish to adhere properly, the skin must be made thoroughly dry. The best way is immersion for a few seconds in absolute alcohol (90 per cent.). The excess of hypochlorite solution should first be wiped off. The hands are then dried by allowing the alcohol to evaporate, or drying them with a sterile compress. Enough "Yzol" is then poured into the palms to cover, by rubbing over, the hands, wrists, and forearms.

The varnish, Yzol, is recommended to have this composition:—

Olive oil or poppy oil -	-	-	-	66 per cent.
Spirits of camphor -	-	-	-	30 "
Spirits of marjoram -	-	-	-	1 "
Spirits of sage, thyme, eucalyptus, and cinnamon	-	-	-	3 "

This composition has no harmful effect on the most delicate tissues; on the contrary, it is extremely useful as a dressing for infected wounds. Nearly 100 operations, many of them being intra-peritoneal, have now been performed with the protection of this method, and in no case has any ill-effect of any kind been noted. Bacteriological tests of the skin thus treated showed complete absence of growth in the cultures made. After the operation, the varnish is easily removed with a nail-brush and soap.—(*Journ. de Méd. et de Chir. prat.*, 10 September, 1916.)

Reviews of Books.

Surgery in War. By ALFRED J. HULL, F.R.C.S. Pp. 384. London : J. and A. Churchill.

THIS book, with a preface by Sir Alfred Keogh and an introduction by Lt.-Col. E. H. Pilcher, R.A.M.C., consists in a *résumé* of the methods in use on the Western Front during 1914-1915. As a *résumé*, it undoubtedly is of value, and, at the least, it is really the official R.A.M.C. presentation of the surgery of the War. It cannot be said that the writing of the book has been very good ; the style is amateurish, whilst the X-ray plates shown are both indistinct and free from any unusual interest. One is forced to an impression that the work was hurriedly carried through. The line illustrations by D. G. Greenfield are very lucid and instructive, though the same cannot be said about Mr. Greenfield's chapter on wounds of the abdomen, which consists practically of an extract from a paper by Mayo Robson. In our opinion, the chapter on the bacteriology of wounds, by Lt.-Col. L. W. Harrison, and that on the treatment of wounds by saline, by Lieut. Tanner, are the best in the book. Capt. Miller's chapter on gunshot wounds of the chest is deserving of great praise. Perhaps it is not too much to say that, as a *résumé* of the work done on surgery in war, the book is invaluable ; it should be in the hands of all those men whose work in war surgery is just beginning. It explains how all the time-honoured methods of antiseptics have failed, and what measures are being successful. It indicates to some extent the all-important measures of immobilization to be applied to compound fractures, and the more rigorous treatment of shattered limbs by special kinds of amputation. Happily, too, the book shows the passage of the cases from the firing line to the base, and the steps taken *en route*. It is in the true military side of the subject that Major Hull gives us the greatest help. As one who has seen a great deal of Major Hull's work in France, the reviewer would congratulate him on having provided the most useful of all the many books written on this subject.

Squire's Companion to the latest Edition of the British Pharmacopœia.
By PETER WYATT SQUIRE. Nineteenth Edition. Pp. 1691.
London : J. and A. Churchill. 15s. net.

"SQUIRE'S COMPANION" now appears in two forms. The smaller one, the so-called "Pocket Companion," intended for the use of the busy practitioner whose requirements consist in a knowledge of the therapeutical properties of drugs and chemicals, and of the means for their successful exhibition, was issued last year shortly after the appearance of the B.P., 1914, and was reviewed by us at the time. The larger volume, the lineal successor of the original "Companion,"

used at a strength of from 1.5 to 3, or even 5, per cent., the solution of hypochlorite of magnesia, freshly obtained by the double decomposition of chlorite of lime and sulphate of magnesia, has never attacked the hands of surgeons and assistants after being used for some months. This solution has replaced Dakin's solution with complete success. The strength need not be higher than 2.5 per cent., and should not be below 1.5 per cent. Based upon these facts, Dubard has elaborated a method for completely disinfecting the hands. This consists of (1) cleaning the skin with warm boiled water, soap, and brush; (2) bathing in the antiseptic solution; (3) drying the hands and then applying the varnish.

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There are two objections which detract somewhat from the otherwise wholly admirable character of this work, and we point them out because, in future editions, they ought not to appear. The first is the impression one gets of a willingness to assume praise for "Squire's Companion" which is really due to someone else. For instance, it may be true that the "Companion" recommended, in 1908, that cantharidin should replace cantharides in the official galenical preparations, but, surely, it was ten years previously that Greenish and Wilson actually published alternative formulæ for the official preparations, with cantharidin in place of cantharides? It seems to us that it is really a disinclination to mention by name any pioneer, in matters of this kind, other than "Squire." The other objection is the slipshod phraseology which is so common as to become irritating. It does not require the ability of a genius to write idiomatic English. It is a talent which can be hired, and ought to be worth hiring to make a satisfactory volume of "Squire's Companion"—a work which has become a classic of English pharmacy. The publishers have printed the book in their usual excellent fashion, and it is a good example of typical English typography of the first class.

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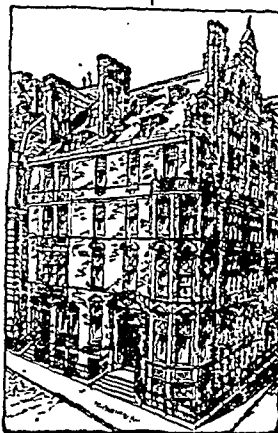
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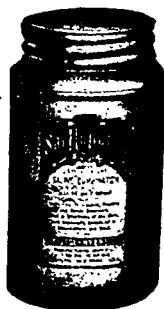
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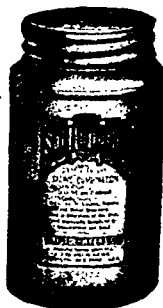
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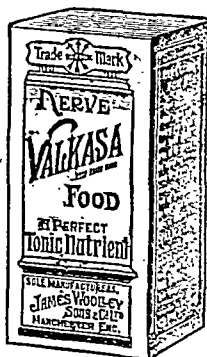
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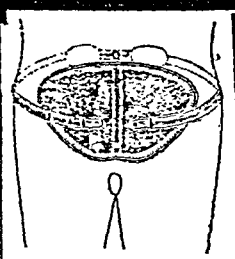
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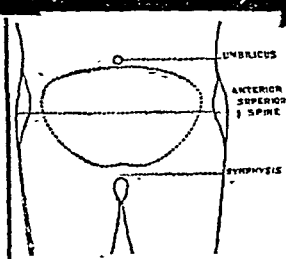
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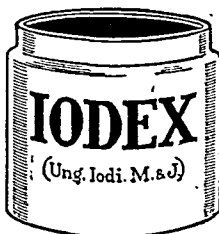
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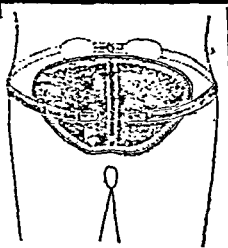
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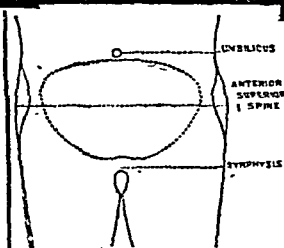
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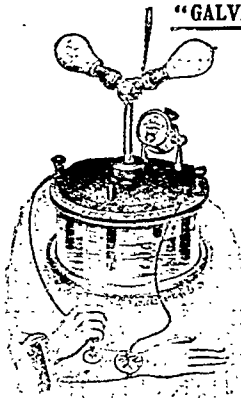
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Tetanus Antitoxin, Antistreptococcic Serum, Antimenigitis Serum and a full line of Biological Products.

Bismuth - Formic - Iodide Comp. Powder
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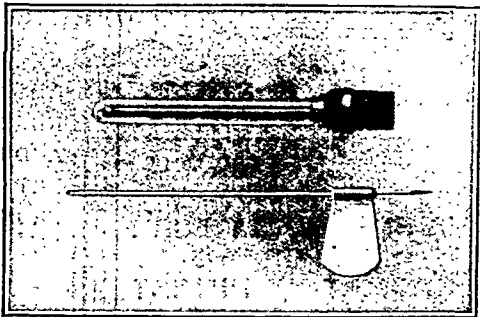
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1. No one has successfully imitated the digestive value of Lactopeptine. :: :: :: :: :: ::
2. Lactopeptine is an ideal digestive remedy which commends itself to every Medical Practitioner on account of its uniformity of action, published formula, and extreme palatableness. ::
3. Lactopeptine is one of the certainties of Medicine, and in this respect ranks with quinine. :: :: :: ::
4. INDICATIONS. Dyspepsia, Infantile Diarrhœa, Acute Indigestion, Morning Sickness, Impaired Nutrition, Flatulent Dyspepsia. :: :: :: ::

When prescribing specify in all cases Lactopeptine (Richards).

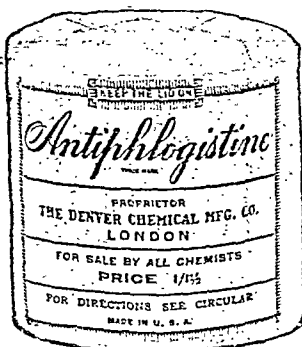
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Directions:—Always heat in the original container by placing in hot water. Needless exposure to the air impairs its osmotic properties—on which its therapeutic action largely depends.

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How the Test is Made.—Select a site on the skin of the arm, cleanse and sterilise, and inject the Luetin into the skin as superficially as possible. The injection should be made **between the layers of the skin and not under the skin**. If properly done a small pale swelling is produced, which subsides in from 10 to 15 minutes.

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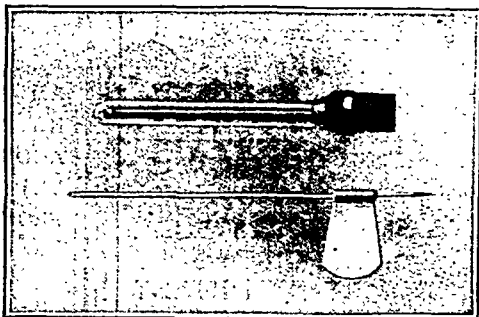
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INADEQUATE Performance of the Depurating Functions by the Kidneys, with all Sequential Troubles: in ARTHRITISM, URIC ACID DIATHESIS, GOUT, GLYCOSURIA, CHOLAEMIA, HYPERTENSION in its developed or initial stages, ARTERIO-SCLEROSIS, GRANULAR KIDNEYS, and AUTO-INTOXICATIONS, occasional or habitual.

THE water may alternatively be used as a table water, or for general dietetic purposes, or as a definite means of treatment. The precise technique of its employment at home naturally varies with each case. In some persons a course of the water is indicated once or twice each year—in spring and autumn—as much as a bottle, or even a bottle and a half, in doses of one large glass every twenty minutes, being taken every morning for twenty or twenty-five days. In others it is better to limit the course to ten or twelve days, and to administer only one or two glasses each morning before breakfast. When this is done, the treatment may be renewed more frequently—say, every two or three months, or even every month. Some, again, find it of advantage to take a large glass of the water either on rising in the morning or at bedtime, while others find it sufficient to use the water at meal-times, either by itself or mixed with wine. Finally, there are cases in which its use need only be occasional—when, for instance, there is some temporary illness or disorder.

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Use of the water can, and should, be continued persistently, in view of its action both on the phenomena of nutrition and on diuresis, which maintains the permeability of the renal tissue and its activity.

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November 16th, 1914.

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(Signed) SAMUEL RIDEAL.

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“Superior to ‘Lysol’ as far as I have tried it.”

“‘TOXOL’ is very satisfactory. The Medical Profession ought to feel grateful to Sir Jesse Boot for replacing a German article in such a prompt and satisfactory manner.”

“Am using sample, and I am so pleased with it that I shall continue to use ‘TOXOL’ in future.”

“Many thanks; have used solutions of ‘TOXOL’ in various strengths, for numerous minor surgical cases with most satisfactory results.”

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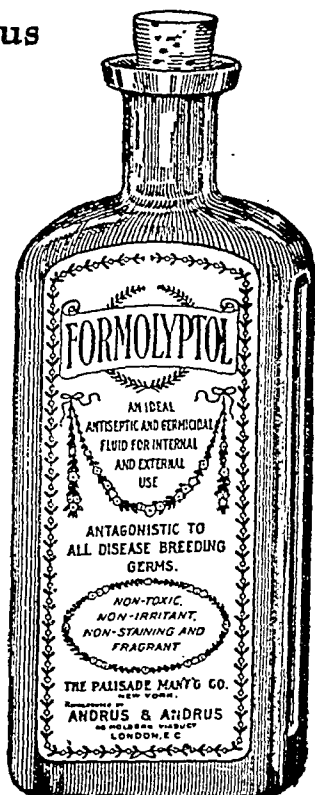
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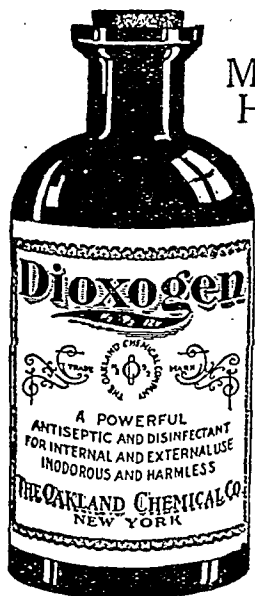
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"Dioxogen" destroys pathogenic micro-organisms, checks purulent and foul secretions, and dissolves false membranes and sloughs.

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AND MENTAL DISORDERS.

Where continuous bromide treatment is necessary, the daily use of 'Sedobrol' Roche combined with the withdrawal or limitation of salt, has proved an excellent routine treatment. (Ulrich).

A Cup of Hot 'SEDOBROL'

has the flavour of a savoury bouillon, and is made in a few moments.

'Sedobrol' Roche contains 17 grs. (1.1 gm.) of Sod. Bromide in combination with fat and spicy extractives of vegetable proteins.

'Sedobrol' Roche is PALATABLE, ASSIMILABLE, and SAFE.

DOSE: One or more tablets at bedtime or whenever necessary.

In tins of 10, 30, 60 & 100 tablets, of all Chemists.

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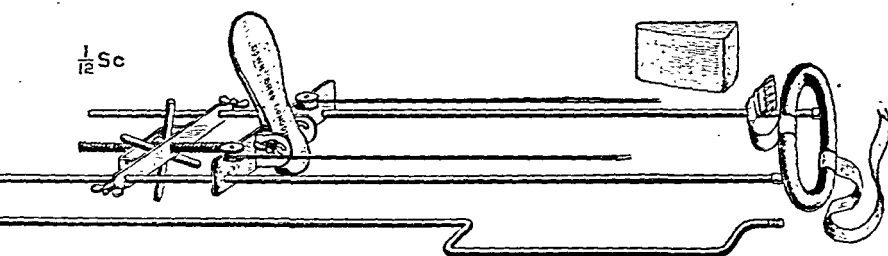
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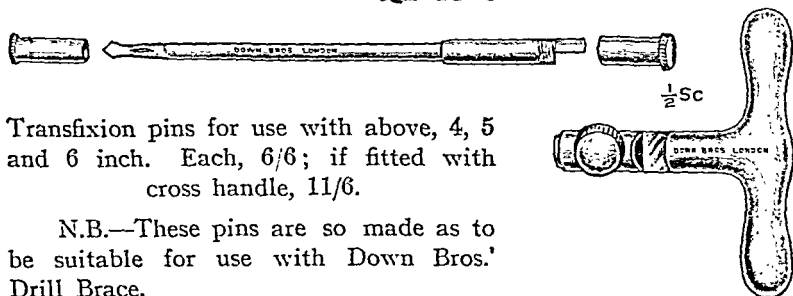
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The advantage claimed is that extension is steadily applied without imparting any unnecessary movement to the limb.

The Splint is supplied with extra cranked bar, as illustrated, for use in case of open wounds, etc., and wedge-shaped pad to insert under the outer ring to ensure bearing on the tuber ischii.

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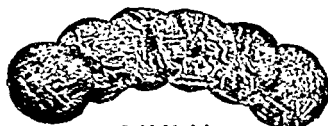
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For years Corporations of the Midlands, such as Sheffield, Lincoln, and Rotherham, have grappled with the task of conserving infant life. The officials and the Welfare-workers have had to face the feeding difficulties in countless cases. Earnest and sincere, these workers have patiently

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THE PRACTITIONER.

OCTOBER, 1916.

ALLEGED INCONTINENCE OF URINE AND MALINGERING.

BY SIR JOHN COLLIE, M.D.

*Medical Examiner, London County Council ; Chief Medical Officer,
Metropolitan Water Board ; Medical Examiner to the
Shipping Federation and Various Insurance
Companies.*

PROBABLY of all the symptoms that a malingerer can simulate, one of the most baffling is incontinence of urine. Fortunately, this particular form of malingering is rare. When medico-legal cases are sent for examination and report, there is usually only an opportunity for a single examination, lasting perhaps a short hour, which makes it well nigh impossible for the examiner, whatever his suspicions, to disprove allegations of this particular disability when put forward by even a tolerably cunning impostor.

The probability, that the existence of so distressing a symptom would be accepted by an employer or insurance company without demur if alleged, throws an overwhelmingly great onus of proof upon the medical man who is bold enough to make the accusation that the incontinence is feigned. The improbability of such a disgusting state being willingly and designedly brought about may very well make most of us, except those who are accustomed to dealing with fraud in all its contemptible forms, hesitate to believe that a fellow human being would deliberately subject himself to such a degrading procedure for gain.

Unfortunately, in the large number of fraudulent claims daily made, there is a percentage, probably a small one, in which such claims are made, though, in my experience, they are seldom persistently proceeded with. I have frequently been able, especially in the case of soldiers, to dispose of the allegation of incontinence at a very early stage, by the simple expedient of examining the patient's pants or trousers, and pointing out that their condition clearly

negatives the allegation. If successfully persisted in, such cases would inevitably lead to gross injustice, by causing the payment of large sums by employers or insurance companies. It is obvious that the only available method of detecting cases of this sort is by the supervision to be obtained at a public institution. Here a calm atmosphere of impartial yet devoted nursing throws the simulant off his guard, and an alert medical officer and a sagacious nurse may, in a week, prove the truth of that which one or more astute medical examiners of life assurance companies may have suspected but failed to prove from lack of the necessary facilities. Such a problem presented itself in a case which was recently sent to me by an insurance company.

The following case is intended to exemplify the value of a thorough examination, and the importance of detail when dealing with those who deliberately attempt to set their wits against those of the medical examiner. Moreover, the subject is a complicated one, and the task of proving, by circumstantial evidence, to a lay Arbitrator that the centre controlling urination is *not* affected as alleged is in practice very difficult.

It is impossible to prove fraud in a case of this sort without having clear views as to the physiology of micturition, and in order to give as much assistance as possible to those having similar cases to deal with, I have added a short summary of the present state of our knowledge of the physiology of the subject.

A. B., a fitter employed by a firm of soap manufacturers, sustained an injury on March 23, 1910. Sixteen months later, the employers applied for release from their obligation to continue the payment of half wages, on the ground that he was fit, if not for full work, certainly for the light work of lift attendant which they had twice offered him in vain, and which they were still prepared to give him.

In the first instance, he had only complained of pain in the back and *left* side on which he had fallen. When the question of review of compensation was first raised, he alleged a number of new symptoms, including, especially, *incontinence of urine*.

In view of the alleged incontinence and the difference of medical opinion brought forward, the application to the court failed, and compensation was continued.

Three years after the accident, A. B.'s troubles had greatly increased. He complained, *in addition*, of pain in the *right* hip and groin, vomiting, headache, and attacks of semi-unconsciousness, and

now alleged that the incontinence began three months from the date of the injury.

He was examined by Dr. A. and watched by private detectives on behalf of the employers, and, on the strength of their reports, the applicants requested A. B. to submit himself to examination by me. He agreed to make the journey to London provided he might take his own medical man with him, and be indemnified against possible hospital expenses in the event of his having to enter a hospital as the result of the journey. An agent for the company, with whom the employer had insured, met him and his doctor at King's Cross, three months later, and brought them to my house. He was carried by porters from the train to a cab.

On arrival about 2.30 p.m., A. B. was carried by four or five bystanders into my house, where he was laid on the floor, and there he remained, groaning at intervals, till 6.15 p.m., refusing to make any attempt to get up and go into my consulting room for examination. As he asked to be sent to hospital, arrangements were made for his admission to the Seamen's Hospital, Greenwich. Another doctor who was present when he was helped to his feet reported: "I saw A. B. leave the premises; although clinging to his crutches or anything he could lay hold of, and apparently undergoing great physical stress, he showed no sign of perspiration or quickened respiration. He drags his 'paralysed' leg behind him, and does not swing it round in the usual way."

On admission into the Seamen's Hospital, the house surgeon noticed that the man's clothes were soaked with *fresh* urine, but that neither the skin of the scrotum nor the thighs were sore or sodden.

The additional symptoms at this time included: pain in the right testicle and thigh as far as the knee, giddiness and double vision, tenderness, on examination at a spot five inches above the tip of the coccyx and three-quarters of an inch to the right of the middle line.

On examination, he gave confused and contradictory answers when sensory tests were applied; the muscles gave good responses to electric stimulation, and were normal on both sides, without any "reaction of degeneration."

Radiograms showed no bony change in spine or pelvis. While giving his history, which lasted nearly an hour—his attention being fully occupied—he passed no urine, though the bladder was afterwards found by catheter to contain eight ounces. The catheter was firmly gripped by the sphincter vesicæ, which normally controls the escape of urine.

Two days later, I thoroughly examined him with a negative result. I found that, by diverting his attention, one could press on the alleged sacral tender spot without eliciting evidence of pain. Knee jerks, plantar reflexes, etc., were tested in the routine way, and all proved normal.

There was never any distension of the bladder at Greenwich Hospital, and the sphincter ani acted normally. He left the Sea-

men's Hospital of his own accord, after a twelve days' stay. He next appeared at Leeds General Infirmary two months later, where Dr. Y. found that he resisted the application of tests, that the power of the right leg was good, and that, though careful watch was kept, there was no incontinence during his *five days'* stay in that hospital. Dr. Y. came to the conclusion that the man was malingering and suffering from no organic disease whatever.

A month later, an important re-examination took place at Leeds. Drs. B. and C. (in the presence of a doctor acting for A. B.) found that the alleged spinal lesion had remained stationary in its effects for three years, that no Babinski or other signs of cord lesion had developed, that the urine was normal—not that of a paralytic bladder—that there was no incontinence during examination, that the sphincter ani was efficient. The man stated that his sexual power was unimpaired. Moreover, he passed the Romberg test, and, though audibly groaning, suffered from neither perspiration nor rise of pulse rate.

There was a suggestion of a settlement for several hundred pounds; I strongly urged this should, on no account, be agreed to.

Three years and nine months after the alleged injury, the case came on for trial before His Honour Judge Greenhow.

The house surgeon of the Seamen's Hospital gave evidence in accordance with his report.

I gave evidence as to the results of my first interview with A. B. and my subsequent examination conducted at the Seamen's Hospital in the presence of the house surgeon, and explained that hesitating answers to electrical and other sensory tests suggested a lack of straightforwardness on the part of the examinee, and emphasized my opinion that, in cases of alleged pain in the back, when no sign of injury thereto, or of injury to the spinal nervous system, can be discovered (by exhaustive examination) after the lapse of a year, a doctor is entitled to conclude that there is nothing seriously wrong.

The evidence of one of the doctors who examined at Leeds was especially valuable, because he had at first been entirely inclined to be on the man's side, and think his sufferings genuine. He detailed his findings, and suggested that a difficulty he experienced in getting one of the knee jerks might be due to voluntary restraint.

The other doctor present at the same examination drew attention to the stationary character of the alleged lesion of the spinal cord centre for micturition. He pointed out that, in spite of its close and intimate association with the centres for defæcation and the sexual act, yet, admittedly, none of these functions were interfered with. He emphasized the importance of the healthy character of A. B.'s urine after three and a half years' alleged incontinence.

The fact of no incontinence at Leeds Infirmary was proved by the hospital doctor and the nurse who had to change his sheets.

The doctor, who was present on A. B.'s behalf at the recent examination, said that the urine was "rather foul," and stated that he suffered from cystitis. Pressed in cross-examination, he would not

swear that the alleged cystitis had anything to do with the accident, and, on being challenged by counsel as to what the man was suffering from, replied: "I am quite unable to give you a diagnosis, sir."

Another doctor said that A. B.'s complaints were never inconsistent with each other or with genuine suffering, but, on cross-examination, he could not account for the incontinence, and admitted that he had never examined the patient's urine.

A third doctor thought the complaints were genuine, but, on cross-examination, said he had never examined the urine, because there were no signs of cystitis while he was under his care.

A. B., who walked with difficulty on crutches, adhered to his allegation of incontinence.

Judgement was given for the applicants with costs.

Subsequent History.—It appeared that, six months later, he had taken a greengrocer's shop, and had been seen carrying a basket of vegetables from his cart to the shop; to do this he used both hands, and consequently had discarded the aid of his stick and crutch, which he still apparently carried with him in his cart on his rounds. About this time he was seen at a race meeting, where he walked about freely, and appeared to have little difficulty in making his way in the crowd; he carried his crutch, but put very little weight on it.

Eight months later, someone kindly sent me a newspaper-cutting from the police proceedings in his neighbourhood, from which it appeared that, after removing his coat, he had engaged in a free fight with a motorist. He stated in court that, if he had wanted to, he could have thrown the plaintiff to the other side of the road.

A few months after the outbreak of war, he enlisted in the Navy and was engaged in mine-sweeping. He had since returned home on leave, and was said to be looking exceedingly smart, and, except for a slight limp, he bore no traces of any disability.

The difficulty of determining the reality of disabling pain in the back is well shown by the difference of medical opinion exhibited in court on the first application for reduction of compensation, on the ground of A. B.'s fitness to undertake the light work offered, a difference in opinion which led the judge to dismiss the application. Such difficulties are much enhanced, when the "patient" has succeeded in persuading his own doctor to believe in his *bona fides*, as in this case.

On reviewing the case as a whole, one is much struck by the increase in the number of symptoms alleged by the patient, and by the changes in their situation; for instance, from the left to the right side.

The most noteworthy addition to the symptoms of pain

in the back and left side originally complained of was, of course, the alleged incontinence of urine, and the only means of direct disproof was to place the patient in hospital under careful and intelligent scrutiny night and day.

It is not surprising, therefore, that the doctors, who examined this man in the latter part of 1910 and 1911, should have expressed their opinion very cautiously as regards this matter. One of the company's doctors in particular showed his impartiality by his favourable attitude towards A. B. in the first instance; and his gradual conversion, by the accumulation of evidence, to the view that he was malingering is a noteworthy feature of the case.

The gradual increase in symptoms is characteristic both of the neurasthenic and the malingerer, but neurasthenia never *per se* leads to incontinence of urine, and *does* lead to decided increase of knee jerks which was, however, absent here; the knee jerk on the side most affected in 1913 was, if anything, rather less than that on the other side.

Throughout, A. B.'s conduct gave rise to suspicion. His refusal to make any sort of trial of the light work offered by his employers—probably for fear of losing a claim to lump sum compensation—in which refusal he was unfortunately supported by his own doctor, his limp on the premises and in the vicinity of his employers' works, coupled with his sprightly walk elsewhere as witnessed by an enquiry agent and later by a doctor, and his refusal in 1911 to have the matter brought before a Medical Referee, all combined to throw doubt on his *bona fides*.

Later on, when examination by me was proposed, his expressed anticipation of going to hospital, his every endeavour at my house to render examination difficult or impossible, served to deepen suspicion against him.

Questioned as to past history, he was voluble enough, but when it came to answering tests of sensation, he was at once on his guard, and his replies became hesitating, vague, and contradictory. Had there been a fracture of the spinal laminæ, he could hardly have walked home, even with such help as was rendered. The incontinence alleged was not mentioned till some *six months* after the injury; had an inflammation of the cord and its membranes been set

up, bladder symptoms should have been observable earlier. Moreover, the alleged incontinence itself failed to come into line with any known form of that complaint.

It could not have been retention overflow, for the bladder was never found distended; nor was it due to paralysis of both detrusor and sphincter muscles, for the amount *proved* to accumulate was quite double as much as a paralysed sphincter can retain even in a paralysed bladder; nor again to paralysis of the sphincter alone, for the sphincter was found by catheter to have no little power of grasping the instrument.

The freshness of the urine, on many examinations, was inconsistent with the theory of imperfectly emptied bladder, for where there is retained urine, after the condition has existed a few weeks, it nearly always becomes alkaline, if not actually ammoniacal, from the entry of the micro-coccus ureæ and the action of intracellular ferment.

Yet all these considerations, taken together, would weigh but little in the mind of a judge as compared with direct experimental proof of power of continence; hence the supreme importance of *observation in hospital*, and the evidence of the doctors and nurse on this part of A. B.'s case.

Having regard to the close association of other centres in the spinal cord with that for micturition, namely, the centre for defæcation and the sexual act, their admitted freedom from disease for three long years was inexplicable on the assumption that damage to the cord had resulted from the accident.

At the trial, the evidence tendered on behalf of the patient was characterized all round by vagueness, an inability to account at all for the symptoms believed to be genuine, and by defective observation, such as omission of urine analysis and the like. One witness "thought there must be something in it," but "couldn't say what"; another was unable to give a diagnosis, and a third "had no idea of the cause of the incontinence," and had never troubled to test the urine during eighteen months!

This is the kind of thing that so favours the plausible malingerer; confiding trust in his statements and vague supposition that there "must be something in it."

In conclusion, it may be mentioned that a compromise

was seriously discussed on more than one occasion, but, being convinced that the claim was an improper one, I strongly urged the insurance company to fight it out, with the result that they were not only saved the payment of many hundreds of pounds, but they gained a success of no little value.

It transpired that A. B. informed the house surgeon of the Seamen's Hospital that he knew I had written on the subject of Malingering; hence, no doubt, his determined unwillingness to be examined by me at my house.

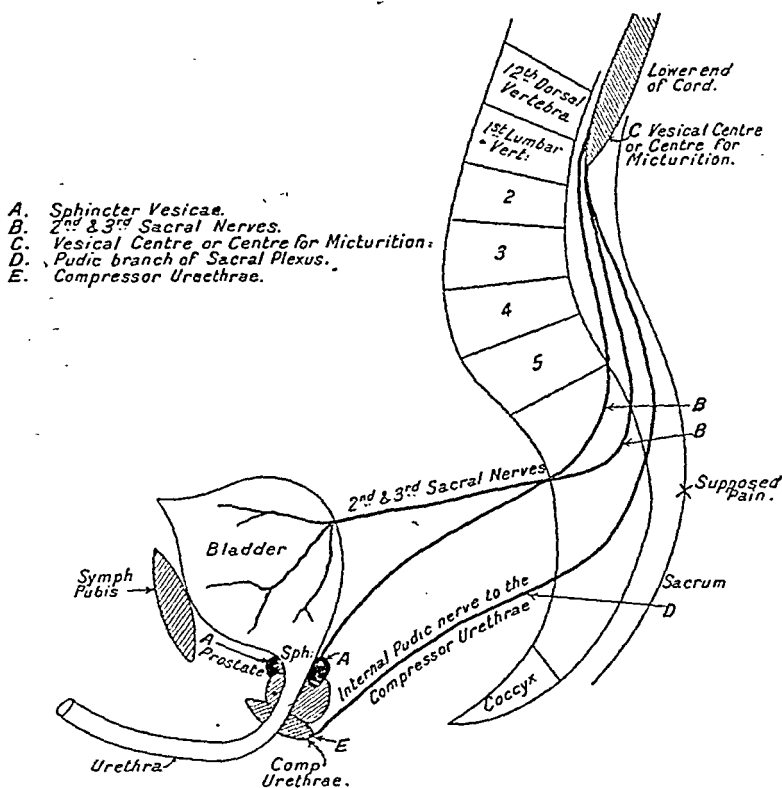
PHYSIOLOGY OF MICTURITION.

The act of micturition, or passing water, is, in theory, a reflex one, *i.e.*, an unconscious mechanical response to stimulation. The stimulus is the ever-increasing pressure of the urine steadily accumulating within the bladder. The urine accumulates, because the exit from the bladder by the urethra is closed by the *steady* contraction of a more or less circular muscle, the *sphincter vesicæ* or sphincter of the bladder, (*see A* in diagram), which embraces the neck of the bladder. Antagonizing the sphincter at the neck of the bladder are the fibres of the circular, the longitudinal, and the oblique muscles of the body of the bladder. The sphincter and its antagonists are so coupled together in the nervous system, that nervous impulses, which increase the action of the one, diminish the action of the other.

When the pressure within the bladder reaches a certain height, nervous impulses pass up through certain nerves in its walls (*B*) to a particular group of cells forming the centre for micturition or vesical centre, (*C*) in the lumbar enlargement of the spinal cord, situated on a level with the last dorsal and first lumbar vertebræ; that is to say, from three to four inches above the level of the crest of the hip bones. These impulses so influence the centre that it sends out other impulses to the bladder, which tend to make the bladder walls contract, whilst, at the same time, the sphincter (*A*) relaxes.

But for the presence of another factor (so far ignored whilst considering the mechanism, as a simple reflex arc) the urine would always be voided when the pressure in the bladder reached a certain amount, as it is by the human

infant. This other factor is the volitional *control* exercised by the cortex and other parts of the brain. In the human race this control is lacking at birth, and is only acquired



by training, sometimes with great difficulty, during the first two, or at most three, years of life. Volitional control is exercised by the cortex and certain parts of the mid-brain through another set of nerve fibres, which pass down the spinal cord as far as the *vesical centre*, and reach the bladder through the sympathetic system. These act directly from the cortex, and are the physiological antagonists to the reflex arc which we have seen ends in the vesical centre.

In the adult, when sensory impulses pass freely from the bladder to the vesical centre, they are not acted upon forthwith by that centre, but are referred to the brain and

realized in consciousness as a desire to pass water. This desire calls up in association feelings of cleanliness and decency, and consideration of circumstances, and when the circumstances are recognized as favourable, the cortex responds by reinforcing the part of the vesical centre for contracting the bladder at the expense of the part for contraction of the *sphincter vesicæ*, so that, while the bladder walls contract, the sphincter relaxes its grip on the neck of the bladder, and micturition takes place unimpeded. By this direct connection with the higher centres, micturition can be started apart from the reflex act.

The brain can, by direct control, also prevent micturition. This is brought about through the pudic branch of the sacral plexus (D) acting on the compressor urethræ (E), a muscle which embraces the second or membranous portion of the urethra, and which, when excited, keeps it firmly closed. This muscle more especially comes into play when the amount of urine accumulated in the bladder exceeds about half a pint, and the pressure therein is unduly raised, with a feeling of more or less urgent desire to pass water, by the cognition of circumstances as unfavourable to, or prohibitive of, that action.

Once acquired, volitional control soon becomes the dominant factor in the mechanism, as the healthy child develops, so that, while "reflex in theory, the act of micturition becomes volitional in practice" (Halliburton). This power of cerebral control is lacking in some idiots, and often becomes defective at night in neurotic children of three or four years of age, occasionally in older children. Severe fright in young people, and terror in adults, *e.g.*, young soldiers in their first battle, impair cortical control, and urine often passes reflexly in these conditions. Fear also heightens, for the time being, the sensibility of the vesical centres, while inflammation of the bladder makes its nerves unduly sensitive to a comparatively small accumulation of urine within its walls. These cause increased frequency of micturition, which is often miscalled or sometimes actually mistaken for true incontinence.

The vesical centre consists of two parts, one for the body of the bladder in the upper part of the lumbar enlargement, and the other for the neck of the bladder and its sphincter

is in the lower part. When the upper part of the vesical centre alone is injured or diseased, distension occurs with intermittent overflow, due to unimpaired action of the sphincter, and paralysis of the walls of the bladder. The intermittent overflow is due to excessive pressure at last relaxing the sphincter. If the lower part of the centre alone is injured or diseased, incontinence without distension results from paralysis of the sphincter.

Destruction, serious injury, or disease of both centres causes some retention with continuous overflow from paralysis of all the muscles concerned. In this condition, three or four ounces may accumulate in the bladder and then passive overflow begins. When the lumbar centres are cut off from communication with the cortex by disease or injury, what generally happens is that urine is retained until the bladder is very distended, then the urine begins to overflow, and dribbles away continuously—"overflow incontinence"—such as is often met with in fracture or dislocation of the spine. *True incontinence, therefore, always points to some grave disease or injury of the spinal cord, and in injury of the cord, it shows itself within a few hours.*

Impairment of these spinal centres may be due to growth of a tumour or to occurrence of hæmorrhage as the result of injury. The growth of a tumour would almost certainly progress steadily so as to involve neighbouring centres, such as those for defæcation, and the sexual act, or cause continuous pain by pressure on nerve roots, or other abnormalities, such as loss or perversion of sensation.

A hæmorrhage so small as only to affect the vesical centres, leaving those for defæcation, etc. unimpaired, would rapidly pass away, leaving little, if any, impairment of the control over micturition.

It should be borne in mind that the association of the various centres, for micturition, defæcation, the sexual act, and for common sensation round about the hips and buttocks, in the lumbo-sacral cord, is a very close one, and that consequently, although one of these centres may be affected alone at first, in cases of many months' duration, one or more of the neighbouring centres must almost certainly become affected.



SOME MEDICO-LEGAL POINTS IN CONNECTION
WITH DEATH.

BY WILLIAM A. BREND, M.D. (STATE MEDICINE), B.Sc.

*Of the Inner Temple, Barrister-at-Law; Lecturer on Forensic Medicine,
Charing Cross Hospital.*

CERTIFICATION OF DEATH.

CERTIFICATION of a death is an obligation imposed upon medical practitioners by law, without entitling them to remuneration from either representatives of the deceased or the State. Since the duty is one which demands the exercise of professional skill and knowledge, the ground for payment of a fee is stronger than that attaching to an obligation which merely demands certification of a fact within the competence of an untrained person, such as the notification of a birth. On the other hand, the view might be taken that the right to certify a death is in the nature of a privilege, and is indirectly of value to the medical man, since it is one of the points of distinction between him and the unregistered practitioner.

The law relating to the certification of death is contained in the Births and Deaths Registration Act, 1874, Section 20 of which provides that: "In the case of the death of any person attended during his last illness by a registered medical practitioner, that practitioner shall sign and give to some person required by the Act to give information concerning the death, a certificate stating, to the best of his knowledge and belief, the cause of death." Section 39 contains the words: "Every person who refuses or fails without reasonable excuse to give or send any certificate in accordance with the provisions of this Act shall be liable to a penalty not exceeding forty shillings for each offence."

A practitioner is not obliged to have seen a body after death in order to give a certificate, but in the large majority of instances it is highly desirable that he should do so. The only occasions, which reasonably permit deviation from this

course are those where a practitioner has left a patient absolutely moribund, and is informed by a responsible person, a few hours later, that death has actually occurred; in these cases, the certificate provides for the use of the words: "As I am informed." The requirements of the Act relate only to information concerning the death, and not to particulars as to the age of the deceased, etc., but the Local Government Board, or the Registrar-General with the consent of the Local Government Board, have power to alter any of the forms contained in the Schedules to the Act, and it is presumably under this authority that these particulars are required. The practitioner, however, could not be held responsible for their accuracy, since he can only obtain the information from others. A practitioner is not specifically forbidden to give more than one certificate of a death, but as a duplicate might obviously be used for improper or criminal purposes, it should not be given, except upon rare occasions when very strong cause can be shown; as, for example, when the original has, beyond all doubt, been accidentally destroyed.

The person; required by the Act to give information concerning the death, and to one of whom accordingly the practitioner must hand the certificate, are the nearest relatives present at the death or in attendance during the last illness, and in default of such relatives, each person present at the death. This has long been recognized as a very weak spot in the Act, since it renders it difficult for doctors to state the real cause of death in the certificate where this is of such a nature as to reflect upon the character of the deceased or other persons. It is well known that our vital statistics, relating to mortality from venereal disease and alcoholism, are seriously defective in consequence. Sometimes, attempt is made to convey the information in terms not familiar to the layman, such as "congenital debility (spirochætal)," "hepatic cirrhosis ($C_2 H_6 O$)," etc., but such devices are not likely to deceive educated persons with access to medical dictionaries. In concealing the fundamental cause of death, practitioners are certainly not acting in accordance with the law, but they cannot seriously be blamed for doing so while the law remains in its present state. The Select Committee on Registration and Certification of Death called attention, as far back as 1893, to the difficulties which arise, but so far

SOME MEDICO-LEGAL POINTS IN CONNECTION
WITH DEATH.

BY WILLIAM A. BREND, M.D. (STATE MEDICINE), B.Sc.

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Charing Cross Hospital.*

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stood, however, that there is no statutory obligation whatever upon a medical man to report a death to the coroner ; it is a matter of courtesy, and should be so regarded by the coroner. Nevertheless, the advantages to the community are so clear that, if the custom were not voluntarily followed by practically all doctors, it would no doubt very soon be made compulsory by Act of Parliament. It is only on rare occasions that the doctor is justified in adopting one of the other courses indicated above, but if he should decide to do so, he is acting strictly within the terms of the statute. This leads to the question as to what deaths should be reported to the coroner.

WHEN TO INFORM THE CORONER OF A DEATH.

The Coroners Act, 1887, lays down that: "Where a coroner is informed that the dead body of a person is lying within his jurisdiction, and there is reasonable cause to suspect that such person has died either a violent or unnatural death, or has died a sudden death of which the cause is unknown, or that such person has died in prison, or in such place or under such circumstances as to require an inquest in pursuance of any Act, the coroner, whether the cause of death arose within his jurisdiction or not, shall, as soon as practicable, issue his warrant," etc.

The wording of the law is fairly clear, though it is not always easy to define the term "unnatural," but the practice varies within wide limits. The evidence given before the Departmental Committee on Coroners' Law and Inquests showed that different coroners hold very different conceptions of their duties, and practitioners who have had experience in different parts of the country will probably have realized the same thing. Many take the view, that their essential function is to determine whether or not crime has been committed, and if the circumstances of the death are free from suspicion they will decide not to hold an inquest, even if the pathological cause of the death is quite uncertain. Others appreciate the importance of holding an inquest for purely scientific and statistical purposes. Some coroners consider that they are bound to hold inquests upon all deaths under anæsthetics, and others only if there are allegations of negligence ; whilst others will ask the doctor to distinguish

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A much more serious evasion of the law is the certification of a death from criminal abortion under some such term as peritonitis or septicæmia, since this is assisting in the concealment of crime. Strong pressure may be brought to bear upon the doctor in the case of an unmarried girl, but if he yields to this, the consequences may be exceedingly unpleasant for himself.

The Births and Deaths Registration Act does not instruct or authorize a doctor to refuse a certificate on the ground that the death was not due to natural causes. It is true that he is not liable to a penalty for failing to give a certificate, if he has "reasonable excuse" for his action; but nowhere in the statute is any indication given of what is meant by reasonable excuse. It would appear that a doctor would be acting strictly within the terms of the law, if he gave a certificate stating that death was due to hanging or stabbing or any other form of violence. In this case, the procedure would be that the certificate would be sent to the registrar, who, seeing that the death had not been due to natural causes, would forward it to the coroner, and an inquest would follow. But this would obviously lead to delay, during which a criminal might escape or valuable evidence be lost. A similar result would follow mere withholding of the certificate unaccompanied by the further action, the death then coming before the registrar as an uncertified death, all of which must now be reported to the coroner. It may be assumed that, if the doctor believed that the death was not due to natural causes, he would have "reasonable excuse" for withholding the certificate, and would, therefore, be technically justified in his action. Under these circumstances, the practice has been established of the doctor refusing to give a certificate, and himself directly reporting to the coroner deaths under suspicious circumstances or from unnatural causes. It should be under-

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certifying he should report the death.

Apart from any question of violence, the medical man cannot give a certificate, if he is unaware of the cause of death. If he has been in attendance before death, he should report the case to the coroner, who, if he is assured that there is no reason for thinking that the death was due to causes other than natural, and can find none from his own preliminary inquiries, may advise the practitioner to give a certificate; in which case the death probably goes to swell the Registrar-General's returns of "heart-failure." Sudden death *per se* does not demand an inquest. If a patient, who has long been known to be suffering from aortic regurgitation, dies suddenly without having been seen recently, the practitioner should report the case, and in the absence of suspicious circumstances, express his readiness to give a certificate, if so advised by the coroner, when, in all probability, an inquest will not be held. Coroners, in deaths of this kind, are influenced by the locality of the death, being much more likely to hold an inquest if the death occurs outdoors than if it takes place at home.

The unfortunate differences, which sometimes arise between medical men and coroners, might be less frequent if the former were to endeavour more to appreciate the difficulties which confront a coroner, and put themselves in his place. A coroner has often very scanty information upon which to arrive at a decision as to holding an inquest, and it may be of great value to him, when reading letters or reports from a medical man, to feel that he is dealing with one upon whom reliance can be placed. But in weighing their statements, the coroner has continually to be on his guard against two tendencies. In the first place, the practitioner in a good neighbourhood, anxious to spare the relatives of the deceased the painful publicity of an inquest, is apt to overstate, in his letter to the coroner, those reasons which appear to render an inquest unnecessary, and minimize those of an opposite nature. The coroner then gradually learns to distrust the practitioner's judgement. Occasionally, this tendency is carried to quite improper lengths. If a coroner receives a letter from a doctor, stating that such and such a person has died from pneumonia, that he is quite willing to give a certificate to that effect if the coroner

between deaths *from* anæsthetics and deaths *under* anæsthetics. Medical evidence is almost always called by one coroner, but only exceptionally by another; and the proportion of post-mortems ordered to inquests held ranges from 20 to more than 90 per cent. Circumstances, other than medical, also influence coroners. In rural areas, there is undoubtedly less strict observance of the legal requirements. In large towns, about 20 per cent. of the total cases reported to the coroner are dismissed after preliminary inquiry without the holding of an inquest; in rural and scattered areas, the percentage is about 50, though the incidence of deaths from violence is approximately the same in both types of locality. Moreover, the evidence given before the Departmental Committee showed that the system of paying a coroner on the basis of a rate per inquest held is not always free from objection.

Under these circumstances, it is not possible to lay down hard and fast rules for practitioners to follow, and the best plan is probably for each practitioner to acquaint himself with the views of the coroner for his locality and act in accordance with them. When death has been clearly due to violence, whether accidental, suicidal, or homicidal, there need be no hesitation in reporting it, but difficulty arises over deaths from tetanus, septicæmia and other forms of blood poisoning, which we know are due to infection through some breach of the tissues, but in which there may be no history of injury or violence. Some coroners consider that all these deaths should be the subject of inquiry, though, to be logical, it would seem that the principle should be extended to all deaths from puerperal fever and other conditions in which infection results from the passage of micro-organisms through the skin or mucous membranes. Indeed, every infection is in a sense accidental, and no logical distinction can be drawn between death from septic infection of a finger and death following infection by syphilis. On the other hand, some coroners will not hold an inquest even where there is a history of slight injury followed by septic infection, provided they are satisfied that there is no suspicion of crime or negligence. In all such cases, the medical man should remember that he is not the judge of whether an inquest should be held or not, and if he has any doubt about

he will reserve his evidence until he is on oath in the witness-box.

SUMMONS TO ATTEND AN INQUEST.

A practitioner who is summoned to attend and give evidence at an inquest must obey that summons. Failure to do so without good and sufficient cause renders him liable, on summary conviction on the prosecution of the coroner or any two of the jury, to a fine not exceeding five pounds. The practitioner is entitled to a fee of one guinea for giving evidence, and one guinea for making a post-mortem examination, provided that this is done by direction of the coroner.

THE MAKING OF AUTOPSIES.

The law relating to this subject is contained mainly in the Anatomy Acts, though sections of the Coroners Act and other measures are relevant. Although there is no legal right of property in a dead body, the corpse is in lawful possession of the executors or relatives of the deceased for the purpose of disposing of it according to law, unless and until the coroner intimates his intention of holding an inquest upon the body, when the possession of it passes to him. A medical man is therefore permitted to make an autopsy upon a body, provided he has the consent of the representatives of the deceased, which should be in writing, unless an inquest is to be held, in which case he can only do so upon a coroner's order. The undesirability, however, of making a private post-mortem cannot be too strongly urged, if there is the smallest possibility of a coroner's inquest being held, or the least doubt that the death was due to natural causes, for the effect may be to destroy valuable evidence indicative of the cause of death and bring severe censure upon the medical man. A post-mortem should only be made by a private practitioner, without a coroner's order, with the sole motive of elucidating a pathological point for purely scientific purposes.

When making a post-mortem for an inquest, perhaps the most important point to bear in mind is the necessity of making a thorough examination of all the vital organs of the body in order that, with deaths from violence, the possibility of natural disease having been the cause may be eliminated. Although this precaution is always urged in lectures to

approves, and is only reporting the case because he has heard something about an accident some time ago, but is sure the death was due to pneumonia, and the coroner discovers, on further inquiry, that the deceased had fallen and sustained a fracture of the neck of the femur, which had never united ; or if the doctor reports a death which he attributes to disease of the heart, but omits to mention that a bottle of poisonous tablets was found by the bedside or a hypodermic syringe in the bed—all cases which have actually occurred—that doctor will always afterwards be distrusted by the coroner, and his doubtful cases are far more likely to be the subject of inquests than if he had acted quite straightforwardly. In the long run, the practitioner will discover that the best means of preventing unnecessary inquests is always to give the coroner full information, and treat him with perfect frankness.

In contradistinction to this tendency, it cannot be denied that, in a poor neighbourhood, cases are sometimes reported unnecessarily with a view to obtaining the fees for giving evidence and making a post-mortem examination. This only applies to a small number of practitioners, but no profession is without some who fail to uphold its honourable traditions.

THE CORONER'S OFFICER.

After reporting a death, or after a death in which the practitioner is concerned has been reported by another, the practitioner will probably receive a visit from the "coroner's officer," who will ask him various questions. This official is not mentioned in the Coroners Act, and he has no legal status whatever. In large towns, he is often a capable police constable or sergeant, but, in other districts, he may be a man of inferior type, instances being given before the Departmental Committee of greengrocers' assistants and unemployed persons acting in this capacity, with evidence that they sometimes receive tips and are amenable to bribery. In the large majority of cases, when dealing with a reputable coroner's officer, the practitioner will not hesitate to give him all the information in his possession, but if, for special reasons, such that personal imputations have been or are likely to be made against him, he prefers not to answer the questions, he is perfectly entitled to refuse, and to state that

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medical students, it is astonishing how frequently it is disregarded, and the writer has known medical men, after giving part of their evidence in the box, sent back to the mortuary in order to open the skull or complete their examination of the stomach or kidneys. If there is any possibility of poisoning having been concerned in the death, the medical man, before commencing the autopsy, should refresh his memory by reading through, in one of the standard works, the precautions to be observed for the protection and preservation of the viscera for chemical examination. It is worth bearing in mind also that the body will subsequently be "viewed" by the coroner and jury, and may be seen by the relatives, the face being exposed for this purpose. The practitioner should therefore avoid making any unnecessary incisions in the region of the face. A practice has crept in at some courts of permitting the mortuary keeper to perform a considerable part of the autopsy, but this is a most undesirable proceeding.

BURIAL OF STILL-BORN INFANTS.

Registration of an infant born dead is not required, though, if it is of twenty-eight weeks' gestation, the birth must be notified under the Notification of Births Act. The burial of such an infant is governed by Section 18 of the Registration of Births and Deaths Act, which provides that: "A person who has control over or ordinarily buries bodies . . . shall not permit to be buried or bury any still-born child before there is delivered to him . . . a written certificate that such child was not born alive, signed by a registered medical practitioner who was in attendance at the birth or has examined the body of such child." Where no registered practitioner has been in attendance, or where his certificate cannot be obtained, a declaration must be made and signed by a person present at the birth, or, if there has been an inquest, an order given by the coroner. Usually the certificate is simply handed to the undertaker, who then disposes of the body, sometimes, there is reason to believe, by placing it in the coffin of another person, a point to remember in exhumations. If interment in a public burial ground is desired, the authorities of the burial ground require a certificate from the medical practitioner to the effect that

the infant was born dead.

CREMATION.

Since cremation removes all further opportunity of examining a body, very stringent regulations must be complied with before it is permitted, in order that no indication of crime or violence may escape detection. These regulations are made by the Home Secretary under the Cremation Act, 1902. They provide that no cremation shall take place unless (1) a certificate be given by a registered medical practitioner who has attended the deceased during his last illness, and who can certify definitely the cause of death, and a confirmatory certificate be given by another medical practitioner, who must be specially appointed for the purpose by the cremation authority, or must hold a prescribed public appointment, or an appointment as physician or surgeon to a general hospital of not less than 50 beds; *or* (2) a post-mortem examination has been made by a medical practitioner, expert in pathology, appointed by the cremation authority (or, in case of emergency, appointed by the medical referee to the cremation authority), and a certificate given by him; *or* (3) an inquest has been held and a special certificate given by the coroner.

The application for cremation and a statutory declaration made by an executor or the nearest relative of the deceased, together with the necessary medical certificates, are submitted to a medical referee appointed by the cremation authority, who has power to make any further inquiries he may think fit. The certificate furnished by the medical practitioner, who attended the deceased, requires him to state whether he is a relative of the deceased or had any pecuniary interest in the death, how long he had been in attendance, how soon after death he saw the body, and what examination of it he made, what was the cause of death, whether an operation had been performed on the deceased within a year before death, by whom the deceased was nursed, who were present at the death, and other particulars. This certificate is handed or sent in a closed envelope to the medical practitioner, who is to give the confirmatory certificate. Besides these observances, the death must be duly registered in the ordinary manner. The procedure seems complicated, but a

practitioner will find, on communicating with a cremation authority, that he will receive every assistance in complying with the requirements.

DYING DECLARATIONS.

When a person is likely to die apparently from the effects of violence (including criminal abortion) inflicted by another, a declaration should be obtained from the dying person regarding the circumstances under which the violence was inflicted. A practitioner should only take such a declaration himself if death is imminent, otherwise he should communicate with a magistrate who will then attend and take the depositions. A dying declaration will only be valid as evidence after the death of the declarant, and then only if it be established that he was fully convinced at the time he made the declaration that he was about to die. The courts rigidly insist upon the fulfilment of this condition, and any expression of hope or expectation of recovery by the injured person will render the declaration inadmissible. The statement should be taken down in the exact words of the dying person, and no questions should be asked save those necessary to clear up ambiguous points. The declaration should be signed by the person making it, though this is not absolutely essential, and by the person to whom it is made, and the signatures should be witnessed. A note should be made of the mental condition of the declarant and of his capacity to give a reliable account of the circumstances attending his injury.

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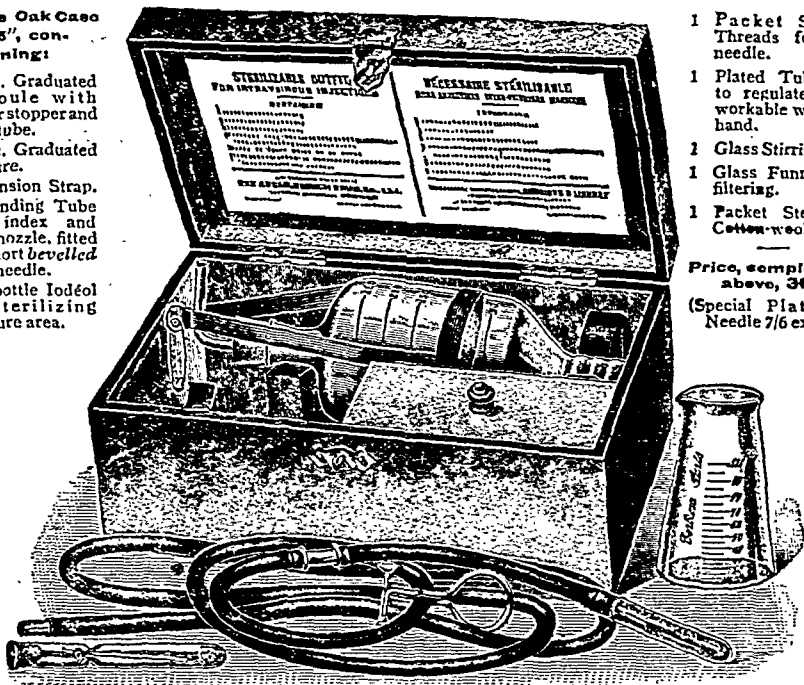
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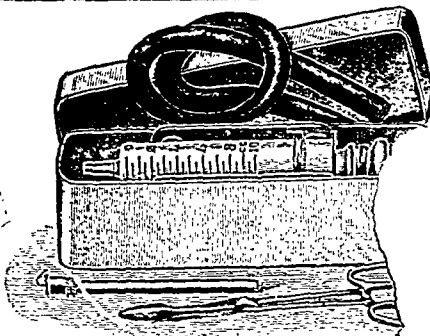
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SURGICAL JUDGEMENT.

By JOHN H. WATSON, M.B., B.S., F.R.C.S.

*Surgeon to the Victoria Hospital, Burnley; Consulting Surgeon to
Reedysford Auxiliary Hospital; Lieut. R.A.M.C. (Temp.).*

"I hold every man a debtor to his profession from the which as men of course do seek to receive countenance and profit so ought they of duty to endeavour themselves by way of amends to be a help and ornament thereunto."—BACON.

SURGICAL judgement means more than the knowledge necessary to make a rough diagnosis, or the technical skill to perform stereotyped operations. It implies a certain clinical experience, which enables one to weigh up the advantages or disadvantages of an operation to a particular patient, the knowledge of the risks and complications besetting such an operation, nay, more, the ability to foretell the benefits that may accrue, and the evils (if any) that may follow after.

Such wisdom is not to be acquired from books alone, but rather from a certain matured experience, combined with much study and careful deliberation on individual cases.

I do not presume to write anything but a brief note on the pitfalls and difficulties that beset a struggling surgeon during the time in which he is gaining his experience, and, consequently, maturing his judgement, so it is for me to state at once that this is not an attempt to indicate how surgical judgement may be attained easily, but rather the reverse, otherwise, a better title would have been "How to become an ideal surgeon," and with as much prospect of success.

The benefits of surgery cannot be realized without the most careful consideration of the patient. No one worthy of the name of surgeon would unwittingly resort to the infliction of a wound on any patient, were it not in the hope of bettering his condition of health, but how often, alas, are ill-considered operations performed. It is a grave mistake to undertake radical operations on all and sundry who may have surgical lesions, without carefully weighing up their advantages and disadvantages. There are many patients who will, and do, live in relative comfort with some obvious

trouble, remediable by operation, but to obtain complete relief would gravely, if not certainly, imperil their lives. On the other hand, there are similar patients who can and do obtain complete relief with comparative safety. These are the select of a sound surgical judgement.

Generally speaking, operations are to be discussed and grouped under two headings, viz., operations of necessity, and operations of choice, expediency, or election. The former, such as the relief of an acute intestinal obstruction, or the treatment of grave injuries, belong to the domain of imperative surgery, and as such require immediate and skilled surgical assistance. It is with the latter class, however, more particularly, that we need the keenest acumen and prudence, or our surgical judgement will be at fault.

We must, therefore, be convinced of the necessity of making a careful and deliberate diagnosis. This demands, at least, a thorough scrutiny of the patient's history, a routine examination, both general and special, which, in these days, often necessitates collaborating with one or more experts or specialists, which our American friends call teamwork. C. H. Mayo says: "It is practically impossible for a single individual to have the personal ability to carry out all the technical details of the general and special examination. For this purpose we must work conjointly, and the findings of the Röntgenologist, laboratory worker, the physician, or other special worker, if need be, should be obtained by the surgeon, in many instances, before a thoroughly comprehensive diagnosis can be arrived at." It is therefore necessary that the modern surgeon should be an all-round man, in order that he may obtain the best from his co-workers, and be able to interpret their findings to the best advantage of his patients.

It is a poor consolation to any surgeon to throw the blame of a faulty diagnosis on the shoulders of some unfortunate colleague, when he has himself already undertaken the entire responsibility. Hence, it is most important that the surgeon should cultivate what are known as the ancillary sciences. In former days, anatomy was looked upon as the key to all surgery. Now our surgeon must be more than an anatomist. He must be a keen physiologist, an industrious pathologist, with no mean knowledge of general medicine, and well acquainted with the advances in Röntgenology.

and other more or less allied subjects.

No man can hope himself to attain a profound knowledge of the theory and practice of all the branches and subdivisions of the surgeon's art. The greater his general knowledge, the less likelihood there will be of his neglecting to obtain expert assistance when required. What is more, he will be in a far better position to interpret the findings thus obtained for his guidance, not only in diagnosis, but in the actual treatment and the discussion of the prognosis. Our surgical judgement can only mature with experience, and even then, one should remember the dictum of the Father of Medicine, greatest of all physicians, Hippocrates: "Experience is fallacious and judgement difficult." Occasionally, we are met by complicated cases in which, even after every care has been taken to obtain all possible help from modern methods, the real clue to a diagnosis is obtained from a more experienced surgical colleague.

Nevertheless, good team-work will enhance our judgement, and ensure better diagnostic ability. We shall, therefore, be able to plan better operations, and thus obtain better results. The man working in this way with able colleagues gets a better and more comprehensive hold of his subject. Many sidelights are opened up, which will broaden his general view of surgery and add to his confidence. His judgement must, therefore, be clearer, more logical, and, consequently, his decision more often correct.

An example of the value of efficient collaboration is the marvellous clinic which the Mayo brothers have built up in the comparatively small American town of Rochester, Minn., U.S.A. C. H. and W. J. Mayo have, undoubtedly, a great genius for organization, and their methods and system have been elaborated by dint of hard work, study, and travel. They have assimilated and adapted in their hospital what is best in American surgery, as well as from the European clinics, and have thereby established, with the aid of an able band of associates, a world-wide reputation for skill and erudition, or, as Garrison puts it "they have made Listerian surgery almost as reliable a science as bookkeeping."

Only by the careful study of our particular cases, by working and consulting with others of greater ability and skill, by visiting the various surgical clinics at home and abroad, and by a constant study of the surgical and ancillary

literature can we hope to emulate such master surgeons, and, in due time, attain something of their skill and judgement.

The necessary dexterity to perform operations can and does come with the frequent repetition of all the various steps, which are best founded on the methods of some surgeon of repute, whom we have been privileged to assist. Operations, to be successful, must be complete. It is infinitely more pleasant to know, as one is closing an abdominal wound, that one has really eradicated some focus of disease or corrected some anatomical displacement or deformity, than to feel one has been able to do nothing more than a so-called exploratory operation, having previously given the patient reasons to hope for a greater measure of surgical relief, if not for a complete cure.

There is no place for haphazard and daring surgery to-day. It is neither in the interests of the future well-being of the patient, nor of the reputation of the surgeon. Beware of being labelled a good practical surgeon. As a rule, this simply means perpetrating the blunders of one's predecessors. There are other bolder spirits who do not know enough to be afraid, and who persist in attempting impossible things, when the wisest course would be to stay one's hand.

The surgeon must have wisdom and foresight to reconstruct his operation according to the findings. It is not good surgery to turn out a chronically inflamed appendix, and leave a badly kinked ileum, nor is it wise, let us say, to suture a perforated duodenal ulcer, and then proceed to do a gastro-enterostomy, when your patient has already had as much as he can stand. Or, again, in the last instance, there may be more wisdom in taking time to explore the condition of the appendix, if the pylorus shows no evidence of stenosis.

The practitioner of to-day is surely learning that, for effective operative work, it is wiser not to send his patient to a mere craftsman, but rather to the man in whose judgement he has learned to have confidence. Having done this, he feels assured that whatever steps are taken they will be thorough. Therefore, I repeat, it is essential for the surgeon of to-day to be capable of applying whatever advances in the subsidiary sciences, especially anatomy and physiology, that may help to the better understanding or alleviation of what Moynihan is pleased to call the pathology of the living.

His observation of asepsis or anti-sepsis must be unimpeachable, his skill in hæmostasis must show an unfailing alertness and, above all, he must be careful and painstaking in the handling of the tissues. He must also be sure that his assistants are imbued with his principles, for he is answerable for any shortcomings on their part. Naturally, owing to the great tension of his work, he may become very exacting, but, considering all these circumstances, he is, at least, entitled to an alert and faithful co-operation.

A great deal has already been written, mostly in odd monographs, as to the relative care that should be exercised in the selection of proper surgical cases, their preparatory treatment, and after-care. Yet, with all deference to the writers of the numerous text-books of operative surgery, I submit that too little space, and not sufficient stress, is made of the importance of a careful physical examination, not omitting a chemical examination of the urine. It may, or may not, be necessary to have a report on the blood, fæces, or sputum from the laboratory expert, or the services of the radiologist may be required, and, as the result of their findings, serious intercurrent disease may be revealed, quite apart from the surgical lesion, which, obviously, needs treatment. Such complications are additional to the surgical problem, and, as such, demand preliminary treatment in order that the condition may be remedied or ameliorated. By this early attention, not only is the mortality reduced, but we obtain a more rapid convalescence, and, incidentally, are enabled to avoid certain post-operative complications.

[¶] In estimating the probabilities and possibilities of an operation, nothing must be left to chance. There is a personal risk in all operations. It is well known that cheerful confident people are, as a rule, good surgical risks, whereas, the doleful and frightened, and more especially the so-called neurotics, are not as likely to make a good recovery, or to show as good a measure of surgical success. Therefore, great care and judgement is required before urging them to accept any surgical procedure, such as a questionable nephropexy or uterine fixation, which frequently ends in more doubtful results.

The question of age in relation to operations is important, although neither extreme age nor early infancy is to be considered a hindrance. Attention should be directed to

the condition of the patient's organs and tissues, rather than to the actual number of years. Infants bear operations well, provided they are not too long or accompanied by too great loss of blood. The cause of death is usually shock from trauma, hæmorrhage, or pneumonia from prolonged anæsthesia. Therefore, the operation must be well planned and quickly executed, trauma and hæmorrhage being reduced to the absolute minimum. In nurslings, it is good policy to secure the co-operation of the mother and arrange for feedings at proper times, if possible.

A person who has lived many years has had, relatively, more opportunity of impairing his various organs than one who has lived a shorter time; moreover, the tissues are in themselves old, and the blood vessels have lost, more or less, their elasticity. Rigid arteries and high tension, as indicated by blood-pressure estimations, are a serious handicap for the patient needing an operation. Despite this, many operations are done on arterio-sclerotic patients—not only those of necessity, but those of selection as well. It is a wise precaution in these cases, should the urine arouse suspicion, to make the functional test of renal sufficiency. Beware of plethoric elderly people, who show indications of myocardial changes, as instanced by the cardio-sclerotic or senile heart hypertension and albuminuria. They are bad risks, and contra-indicate any operative measures, except those of extreme urgency. I feel sure that many old people who undergo operations, die, not from shock, as frequently asserted, but simply because they have, what Mackenzie defines as, a limitation of the field of cardiac response. The operation calls for an extra effort from a cardio-sclerotic heart, to which it is unable to respond, and sudden inception of the nodal rhythm is brought about, which is, in my opinion, not infrequently the cause of death.

Old people do not stand confinement in the supine position at all well. They should be sat up as early as possible, and their convalescence is hastened by getting them out of bed as soon as their wounds will stand the strain, even after abdominal sections and herniotomy.

Special care must be given to the preparation of those patients suffering from constitutional or organic disease. It is far better to keep these patients under observation and treatment for some time, and to watch progress, rather

than to rush them into what may turn out to be a dangerous or even disastrous operation. Trials of this kind, ending in ghastly failures, ought never to be allowed, and can, with foresight, be avoided. As a particular instance, one may have to deal with an extremely nervous young person, who has marked tachycardia, slight tremor, and other minor signs of hyperthyroidism, but without any obvious exophthalmos or enlargement of the thyroid. These cases are bad operative risks, and one should be wary in advising any operation of expediency, for they are liable to die under the anæsthetic, or, later, from acute hyperthyroidism. The condition brought about by the increased activity of the thyroid demands primary treatment. Rest and freedom from mental strain should be enforced, the diet regulated and medicinal remedies prescribed, but no radical measures should be urged until the thyroid symptoms are negligible.

Another group of patients requiring a deliberately planned preparation, are the drug habitués, and those who are more or less poisoned with alcohol. As it is with the latter class we have to deal most frequently, we must be aware that the habitual use of excessive amounts of alcohol greatly increases the risk of surgical operations, and renders the prognosis after an injury or infection more serious.

There is no doubt that the tissues of a chronic alcoholic are greatly impaired, the powers of wound-repair are enfeebled, the resistance to bacterial infection is diminished, and, accordingly, there is a greater liability for the wounds to suppurate or become the site of an acute spreading inflammation; moreover, they are troublesome people to anæsthetize. The immediate danger, after an operation, is an attack of delirium tremens, which may cause no little anxiety to the surgeon, especially if he has to make fresh explanations to the incredulous relatives. Then, again, there may be local disturbances in the wound, and other frequent troubles are visceral complications, such as pneumonia, often of a violent type and ending fatally, cardiac dilatation, nephritis, and acute gastric disturbances.

It is, therefore, necessary to enquire carefully into a middle-aged patient's habits, if there is any cause for suspicion, giving him to understand that the detail is necessary for his ultimate good, and that you are not acting the part of a social reformer. Insist upon him entering a

the condition of the patient's organs and tissues, rather than to the actual number of years. Infants bear operations well, provided they are not too long or accompanied by too great loss of blood. The cause of death is usually shock from trauma, hæmorrhage, or pneumonia from prolonged anæsthesia. Therefore, the operation must be well planned and quickly executed, trauma and hæmorrhage being reduced to the absolute minimum. In nurslings, it is good policy to secure the co-operation of the mother and arrange for feedings at proper times, if possible.

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Special care must be given to the preparation of those patients suffering from constitutional or organic disease. It is far better to keep these patients under observation and treatment for some time, and to watch progress, rather

of only minor palliative measures of a temporary character.

In the last grade, we must remember that even the markedly anæmic, or those stamped with the cachexia of malignant disease, are not to be abandoned until careful nursing and medical treatment have had at least a trial; for, by such means, so considerable an improvement may be obtained that further steps are indicated, and a successful operation can be performed.

We must, therefore, realize that the most important test by which an operation is to be judged is the mortality, and it naturally follows that we must adopt the safest surgical method, and be careful in the selection of the time for operation. For instance, a prostatic case, worn out with constant irritation and straining, and with impaired function of the kidneys and heart, may be rendered a good risk by judicious dietary and nursing, the exhibition of digitalis and mild non-irritating urinary antiseptics and diuretics, regular and careful catheterization or, if need be, supra-pubic drainage. By such means Crenshaw, of the Mayo clinic, has shown that the blood-pressure can be reduced, and the specific gravity of the urine maintained.

Or, again, in cases of carcinoma of the stomach, the patient is rapidly poisoned by absorption of toxic substances from the growth. An immediate operation is impossible, but systematic lavage of the stomach, judicious feeding with concentrated sterile foods, and the free administration of saline combined with glucose, per rectum, will at times improve the condition to a surprising extent, and, in one or two weeks, the patient is thus rendered fit to undergo successfully a radical operation.

When a surgeon suggests an operation, there is always a string of questions to be answered by him. "Is the operation dangerous?" "Will you guarantee a cure?" "Is there no other way I could try first?" and so on. These questions are not to be answered in an off-hand manner, and it is certainly wise not to be dogmatic in specifying the time of convalescence or return to work. The unexpected is always happening, and we shall be wiser to deliberate carefully, and not be led to make statements which may be falsified or give rise to misunderstanding. It may even be

surgical home, where he can receive the necessary dieting and general treatment under the observance of a competent nurse.

In acute infections, the mortality depends directly upon the virulence of the bacterial invasion. Delay in adopting prompt surgical measures increases the risks by leaps and bounds. There must be no hesitation, for an acute infection does not respect either the natural strength or endurance of any individual. Most of us have seen more than once big powerful men cut down by acute appendicitis, even though an early operation has been performed; whereas, on another occasion, a puny youth will go through an apparently similar attack, complicated with recurrent abscess, intestinal obstruction, and fistula, and make a good recovery.

There is no certain way of ascertaining whether we can stay the infection by operation, for there is no rapid way of finding out our patients' power of resistance. Our best guide, as Ochsner says, is the condition of the pulse. An operation on a patient, with a pulse over 120 beats per minute, must always be looked upon seriously, and, with a still higher rate, the gravity increases many fold. An expectant line of treatment, such as Ochsner's, for late cases of peritoneal infection, when carried out systematically, has, undoubtedly, carried practically moribund patients through the crisis, until a more suitable moment for surgical interference has arisen.

With increasing knowledge and judgement, we learn to be fairly accurate in our ability to classify our operative cases into :—

- (1) Good cases, in which there is every reason to presume that, by surgical intervention, we may obtain a complete cure of some local lesion, the patient being otherwise healthy.
- (2) Uncertain cases, in which the prospect of complete cure is doubtful, but in which we can promise a variable amount of relief of a permanent character.
- (3) Bad cases, which are more or less hopeless, the subjects being physically unfit to withstand the strain of the operation indicated, or the disease being too advanced to be eradicated, the condition permitting

so that we may attain the highest degree of fitness that our capacities and opportunities permit. This extract, from the writing of the late Sir James Paget, bears out my meaning : " Sometimes the beam of life and death is so nicely balanced that it turns this way or that, according to the more or less skill that can be cast into the scale of life. If we could gather into thought all the issues that are involved in the life and death of any man, the anxiety of ignorance at such a time would be intolerable. All is permitted to depend upon the skill of one. Consider that one yourself."

It is not my purpose to go into the preparatory treatment, or the technicalities or niceties of an operation. Sufficient has been said to mark the importance of sound judgement, even in the preliminaries of a surgical procedure. The actual detail of preparatory treatment, the organization of the assisting staff and nurses, the problem of the anæsthesia, the technicalities and the niceties of the operation, the prevention of post-operative complications, rather than the after-treatment of surgical errors, are demands more of actual knowledge and judgement on the part of a surgeon than skill in the wielding of surgical instruments. This last, however, is no mean factor, and can only be accomplished by practice and experience, and every opportunity should, therefore, be taken, first to work with a man of real ability, and, secondly, to neglect no opportunity of performing such operations on the cadaver.

This brings me to what may be called the development or cultivation of the surgical conscience. It is a term hard to define. It manifests itself in the feeling of obligation and duty of the surgeon to his patient, no matter who he is or what he is. A good surgical conscience must be based on justice, honesty, and correct reasoning. Hence, it follows that no man can accomplish good surgical work unless his conduct and action are based on a sound knowledge of the underlying principles. These principles are founded on painstaking observations, and are an exact interpretation of natural phenomena.

The science and art of surgery is progressive. Many theories of to-day will be refuted and corrected sooner or later. New ideas and new methods rapidly take their place, which must be utilized by the progressive and conscientious surgeon in his search for the truth and his anxiety for

the best policy to avoid being explicit, as the following story of Sir William Gull emphasizes.

The mother of one of his patients once said to him "You do not tell me anything definite about my boy. Are there any doctors who will?" The rejoinder was "Yes, there are lots of them ignorant enough to tell you all about it."

Most surgeons could recount many surprises in what were supposed to be first-class risks. I know of no more awful ordeal than that of having to meet and tell the relatives of your patient of a sudden and unexpected death on the table. No explanation you can give of sudden heart failure, shock, or peculiar reaction to the anæsthetic, consoles them, or exonerates you, really, in their eyes. Such cases are nothing but the direst calamity to the provincial surgeon, and more than one promising career has been hampered by such an accident.

Here, again, I maintain that the cause of many of these disasters is due, primarily, to the want of care in the proper selection of cases, and not so much to errors of skill at the operation. It is therefore essential that the surgeon must be thorough in his general examination. He ought to be able to find out himself any ordinary visceral lesion that may prejudice an operation; if not, then he must work in collaboration with others who can, whilst he does the purely mechanical part. Personally, I have little opinion of the surgeon who cannot use a stethoscope, who neglects to acquire the secrets of the ophthalmoscope and cystoscope, who professes contempt for detailed analysis of the urine or hæmatological reports as more or less diagnostic fads. Such a man is to be feared by his patients. His scientific training has been at fault, as a rule, and, unfortunately, he has not the foresight to make an effort to understand them, or, he is foolish enough to believe himself to be the proud possessor of some particular clinical acumen. In fact, he is a born surgeon, whatever that may mean. By the indulgence of the State, he is permitted, without any special or adequate training, actually to practise the art and science of surgery on a confiding general public, a task for which he is in every sense unfitted.

In order, therefore, to acquit ourselves honourably of the responsibilities we assume as surgeons, there is no solution of the self-imposed task save in constant work and study,

so that we may attain the highest degree of fitness that our capacities and opportunities permit. This extract, from the writing of the late Sir James Paget, bears out my meaning : " Sometimes the beam of life and death is so nicely balanced that it turns this way or that, according to the more or less skill that can be cast into the scale of life. If we could gather into thought all the issues that are involved in the life and death of any man, the anxiety of ignorance at such a time would be intolerable. All is permitted to depend upon the skill of one. Consider that one yourself."

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The science and art of surgery is progressive. Many theories of to-day will be refuted and corrected sooner or later. New ideas and new methods rapidly take their place, which must be utilized by the progressive and conscientious surgeon in his search for the truth and his anxiety for

the welfare of his patients. The surgeon of to-day has a wider field and greater facilities than his predecessors, yet, as in former days, we shall still get the greatest good from the conscientious observer. I cannot do better than quote an incident from the life and writings of Ambrose Paré, that greatest and best beloved of army surgeons:—

“ A great part of the army being come to the Pass of Suze, we found the enemy occupying it, and they had made forts and trenches, so that we had to fight to dislodge them and drive them out; and there were many killed and wounded on both sides. Now I was, at this time, a fresh-water soldier. I had not yet seen wounds made by gunshot, at the first dressing. It is true, I had read in John de Vigo, that wounds made by firearms partake of venosity, and for their cure he bids you cauterize them with oil of elders, scalding hot, mixed with a little treacle; And to make no mistake, before I would use the said oil, knowing this was to bring great pain to the patient, I asked first before I applied it, what the other surgeons did for the first dressing, which was, to put the said oil, boiling, well into the wounds, wherefore, I took courage to do as they did. At last my oil ran short, and I was forced, instead thereof, to apply the yokes of eggs, oil of roses and turpentine. In the night I could not sleep in quiet, fearing some default in not cauterizing, that I should find the wounded to whom I had not used the said oil, dead from the poison of their wounds, which made me rise very early to visit them, when, beyond my expectation, I find that those to whom I had applied my digestive medicament had but little pain, and their wounds without inflammation or swelling, having rested fairly well that night; the others, to whom the boiling oil was used, I found feverish, with great pain and swelling about the edges of their wounds. Then I resolved nevermore thus cruelly to burn poor men with gunshot wounds.”

Mark the conclusion, after a night of intense mental deliberation, and doubt whether he had done right or wrong, his observations in the morning gave him the answer, and,

what is more, he had the courage of his conviction, and at once began to defy the barbarous practice of his age. To be thus conscientious implies character even more than intellect. A surgeon without a conscience, considering his power for good or evil, must be an anomaly. The surgeon's conscience becomes his guardian. It makes him a careful student of all methods and possible aids that can be utilized to advantage in the performance of the task in hand, and enforces a scrupulous application of fundamental principles.

Having thus thoroughly familiarized himself with his case and properly arranged the details of his preparations, he must conduct the operation with due regard to the anatomy and physiology of the part involved. There must be clean cutting, and no unnecessary dissection. No tearing and mauling, but gentle and effective manœuvres, without undue haste, or, what is quite as reprehensible, senseless deliberation, and further careful and accurate hæmostasis. In other words, our technical duty is well said to consist in gentleness of manipulation throughout a carefully planned operation, based on an accurate regard for anatomy and living pathology, and conducted and completed with faultless aseptic or antiseptic methods.

Let us, therefore, not forget that our success and real progress in the art and science of surgery depends, mainly, on the soundness of our surgical judgement. The surgeon, above all professional men, requires prolonged training in the development of his reasoning powers and mental habits, which render him capable of safeguarding and ameliorating the lives of those who come under his care. No written instructions are, in themselves, sufficient to educate a surgeon. Actual practice on the cadaver, and, again, in hospital under able guidance, is essential to obtain the necessary skill. Useless operations should never be done, that is, we should not attempt any operation without reason to expect a certain measure of relief to the patient, and a complete operation should always be aimed at when conditions will allow. To-day, no surgeon can be master of all the branches of surgical science, but he should know when to obtain the help of the specialist, and, thus knowing his own limitations and capabilities, be not only honest to himself, but, what is more, honest to his fellow men.

the welfare of his patients. The surgeon of to-day has a wider field and greater facilities than his predecessors, yet, as in former days, we shall still get the greatest good from the conscientious observer. I cannot do better than quote an incident from the life and writings of Ambrose Paré, that greatest and best beloved of army surgeons:—

“ A great part of the army being come to the Pass of Suze, we found the enemy occupying it, and they had made forts and trenches, so that we had to fight to dislodge them and drive them out; and there were many killed and wounded on both sides. Now I was, at this time, a fresh-water soldier. I had not yet seen wounds made by gunshot, at the first dressing. It is true, I had read in John de Vigo, that wounds made by firearms partake of venenosity, and for their cure he bids you cauterize them with oil of elders, scalding hot, mixed with a little treacle; And to make no mistake, before I would use the said oil, knowing this was to bring great pain to the patient, I asked first before I applied it, what the other surgeons did for the first dressing, which was, to put the said oil, boiling, well into the wounds, wherefore, I took courage to do as they did. At last my oil ran short, and I was forced, instead thereof, to apply the yokes of eggs, oil of roses and turpentine. In the night I could not sleep in quiet, fearing some default in not cauterizing, that I should find the wounded to whom I had not used the said oil, dead from the poison of their wounds, which made me rise very early to visit them, when, beyond my expectation, I find that those to whom I had applied my digestive medicament had but little pain, and their wounds without inflammation or swelling, having rested fairly well that night; the others, to whom the boiling oil was used, I found feverish, with great pain and swelling about the edges of their wounds. Then I resolved nevermore thus cruelly to burn poor men with gunshot wounds.”

Mark the conclusion, after a night of intense mental deliberation, and doubt whether he had done right or wrong, his observations in the morning gave him the answer, and,

the work of the Medical Department centred almost entirely around the military position, in order to secure that the new troops should be trained under the most favourable sanitary conditions, and protected from the risks of infection that are associated with the massing of large numbers of men under temporary conditions. Active co-operation between civil and military sanitary services was secured. Local knowledge as to water supplies, the best methods of refuse disposal, drainage and conservancy arrangements, infectious diseases hospitals, etc., was readily put at the service of the military authorities and proved of much value; whilst a system of inter-notification of infectious diseases, both by military and civil sanitary officers, was put into force, and proved of use to both sets of officers concerned. At the same time a warning was given to Local Authorities, by the Board, that there should be no relaxation of their activities in the various departments of public health under their control, due to depletion of staffs as the result of civil officers being called up for military service. The War Office also issued a circular to commanding officers, dealing with arrangements for co-operation with the medical officers of health in regard to the sanitation of billets and of camps, military premises being thrown open to inspection by civil officers, area for area. An appeal, if required, was given to the deputy director of medical services, who was enjoined to forward particulars to the War Office, if necessary.

In this way, a large administrative civil sanitary machine was put at the service of the Military Authorities, and this military and civil co-operation will prove hereafter, when the history of the War is written, to have had far-reaching results, as shown already by the comparative absence of diseases of a communicable nature, due directly or indirectly to insanitation, amongst the large numbers of men training and moving about from one part of the country to another. The work that has been involved can only be described fitly as tremendous.

The supervision and inspection of food for troops calls for special attention, if only for the magnitude of the work and the satisfactory administrative arrangements made. Here, again, the Board and the War Office co-operated and were assisted by the Civil Authorities. Two of the Board's Medical Inspectors of Food were sent to Chicago and Buenos

RECENT PUBLIC HEALTH WORK.

By JOSEPH PRIESTLEY, B.A., M.D., D.P.H.

*Medical Officer of Health, Lambeth.*FORTY-FOURTH ANNUAL REPORT OF THE LOCAL
GOVERNMENT BOARD, 1914-15 (MEDICAL OFFICER).

In view of War conditions, the report has been greatly curtailed, but it is none the less valuable as showing the large amount of administrative work accomplished during 1914-15. There are nine sections in all, as follow:—

Section 1.—Medical Department and the War.

Section 2.—The Acute Infectious Diseases.

Section 3.—Tuberculosis.

Section 4.—Venereal Diseases.

Section 5.—Maternity and Child-Welfare Work.

Section 6.—Vaccination and Public Vaccination.

Section 7.—International Hygiene.

Section 8.—Other Work of the Medical Department.

Section 9.—Auxiliary Scientific Investigations.

To the main body of the report are attached seven appendices, dealing with many important matters, and including a complete list of circulars, memoranda and orders issued by the Board in 1914-15 relating to questions affecting the public health; whilst, in addition, there is a large supplement containing a special report on maternal mortality in connection with childbearing, and its relation to infant mortality—a most important contribution on the subject.

In a report which covers so wide an area of work it is difficult to give a satisfactory *résumé* of everything in the space allowed, so that only those portions of the report will be selected which appear to the writer of this article to call for special mention and consideration at the present time.

(a) MEDICAL DEPARTMENT AND THE WAR (SECTION 1).

From the outbreak of the great War, on August 4th, 1914,

tions and agencies of the nature of schools for mothers; that is to say, institutions and agencies which have, primarily, an educational object, *i.e.*, the training and instructing of mothers in the care and management of young children, and their supervision from birth to school age, without specific medical advice and treatment.

The special report on maternal mortality in connection with childbearing, which is issued as a supplement, is a valuable and important one, consisting of 140 pages. The welfare of infants depends, in very large measure, upon that of their mothers, and the supplementary report forms the necessary complement to the Board's previous reports on Infant and Child-Welfare. Childbearing is still associated, in some parts of the country, with very excessive mortality, and, in every part of the country, with much avoidable sickness. The object of the report is to draw attention to this morbidity and mortality, to stimulate further local inquiry on the subject, and to encourage measures which will make the occurrence of illness and disability, due to childbearing, a much rarer event than at present. It is becoming more fully realized that, in order to ensure healthy infancy and childhood, it is necessary that, during pregnancy as well as at and after the birth of the infant, increased maternal care and guidance and medical assistance should be provided.

The supplementary report is divided into four parts:—

Part I.—The national aspect of the question.

Part II.—National loss of life in connection with childbearing.

Part III.—Consideration of conditions influencing mortality from childbearing.

Part IV.—Public health administration in relation to maternity.

Interesting statistical appendices are added, in the form of tables (eight in number), the data upon which the statistical parts of the report are based having been supplied from the Registrar-General's Department.

The national aspect of the question needs no comment; all are agreed about its importance, more especially having regard to war ravage and wastage. Remarkable local

Ayres, respectively, to supervise the exportation of meat on behalf of the War Department.

What has been stated above as to the co-operation between the Military and Civil Authorities applies both to the Army and to the Navy—the necessary arrangement in the latter case being made at the instance of the Lords Commissioners of the Admiralty, in so far as Naval camps, dépôts, or billets on shore are concerned.

(b) MATERNITY AND CHILD-WELFARE WORK (SECTION 5) AND
MATERNAL MORTALITY IN CONNECTION WITH CHILDBEARING AND ITS
RELATION TO INFANT MORTALITY (SUPPLEMENT).

Under war conditions, Parliament has passed the Notification of Births (Extension) Act, and grants have been voted in aid of work done by local authorities and voluntary agencies to promote maternity and child-welfare work.

It is natural that the Board's Medical Officer should deal with the subject of maternity and child-welfare. No more important subject could engage a Public Health Authority's attention at the present time. With the present war-wastage of human life, and with the consequent shortage of available husbands and prospective fathers, it becomes the more necessary to adopt all available means, and to take all precautionary measures, to secure the health of mothers, and to conserve, if possible, the life of every child born, and, indeed, to go further, and to endeavour to conserve the life of every child *unborn*.

Local authorities and voluntary agencies must co-operate together, so as to form, within the respective districts of such local authorities, comprehensive schemes dealing with the extension and systematization of all measures *hitherto* adopted, to a greater or lesser degree, for the prevention of infantile morbidity and mortality, the welfare of children between the ages of one and five years, and the treatment of mothers before, at, and after confinement. To encourage local authorities and voluntary agencies to embark upon schemes for such a purpose, grants in aid of expenditure are offered under certain conditions, both by the Local Government Board and the Board of Education, in respect of institutions, or other provisions for maternity and child-welfare. It may be added that the latter Board restricts its grants to institu-

birth-rate of England and Wales been the same in 1914 as in 1876, 467,837 *additional* infants would have been born in 1914.

2. Deaths during childbearing vary, *e.g.*, Welsh counties have the highest mortality; Westmoreland, Lancashire, and Cheshire come next in order of unfavourable position; Dewsbury (Yorkshire) exacts the heaviest toll of life from mothers in childbearing and is followed closely by Rochdale, Burnley, Blackburn, Bury, Oldham, Huddersfield, Halifax, and Merthyr Tydfil. Scotland, Wales, and Ireland have a higher rate of mortality from childbearing than England, and in the northern division of England and Wales the mortality is higher than in the midland and southern divisions. All these facts point to special *local* factors, other than topographical, being concerned in causing the local excesses of mortality.
3. The majority of the deaths of mothers from childbearing are caused by puerperal fever, hæmorrhage, and convulsions, most, if not all, of which are preventible. Mothers treated in lying-in hospitals suffer less than those treated outside. Excessive mortality of mothers in childbearing means an excessive proportion of still-born infants, and an excessive proportion of deaths of infants in the early weeks after live-birth. Factory work for married women is bad, and this fact, coupled with unsatisfactory midwifery and the use of abortifacients, explains the excessive toll exacted in the textile and other manufacturing towns. There are other factors at work, but these can only be discovered by careful and intensive investigation of *local* conditions.
4. The preventive measures suggested are: the provision of skilled assistance before, at, and after confinement at maternity centres, hospitals or other institutions; compulsory notification of births, of "puerperal fever" so-called (*i.e.*, all septic conditions associated with the puerperium), and even of pregnancy, with the formal and intelligent consent

differences of mortality in childbearing are shown, demonstrating the need for further detailed local inquiry, and for the early application of those remedial measures which may be suggested as the result of such enquiry, *e.g.*, better arrangements for ante-natal care and for midwifery attendance. In this connection, Part IV. sets out some of the work already being undertaken towards these ends. There can be little doubt but that the War will encourage, rather than retard, this nationally important work for securing the welfare of mothers and their infants.

Other combatant nations are considering the subject, and the following official French announcement, given in the *Revue d'Hygiène* of April, 1915 (p. 337), is specially interesting, if only on account of its terseness:—

Office Central d'Assistance Maternelle et Infantile,
Dans le gouvernement militaire de Paris.

Pour les Mères et les Enfants du premier âge.

Parisiens.

Les Pères sont à la Frontière.

Défendons les Mères et les Petits Enfants ;

A leur Aide—et Vite——

L'Office Central, fondé sous le haut patronage de Mme. Raymond Poincaré et la présidence d'honneur de Mme. la générale Michel, accepte avec reconnaissance tous les concours, tous les dévouements et tous les dons.

Sauvons nos Bébés.

Les dons de toute nature sont reçus au Siège social, 64 bis, Rue du Rocher, de 9 heures à 11 heures et de 2 heures à 5 heures.

Vu : Le Préfet de la Seine,

M. Delauney.

GÉNÉRALE MICHEL.

A *précis* of the Board's report (Supplement) on maternal mortality in connection with childbearing, and its relation to infant mortality, may be given as follow:—

1. A declining death-rate cannot keep pace indefinitely with a continuously declining birth-rate. Had the

there and the staff required. Antenatal work is specially dealt with.

- (2) The Epidemiology of *Typhus exanthematicus* in recent years, an exhaustive treatise on the subject, dealing with the disease in the British Isles, Scandinavia, Holland and Belgium, France, Germany, Austria, Hungary, Russia, the Balkan States, Italy, Switzerland, Spain and Portugal, North Africa, Egypt, Turkey, Persia, India, China, Japan, Mexico, Philippine Islands, North and South America, and Canada.

The specific germ of the disease is still unknown, but a *medium* is undoubtedly the body-louse, and even the head-louse to a less extent. Overcrowding, poverty, and personal uncleanness are intimately connected with the disease, which disappears when such insanitary conditions are done away with; indeed, Western Europe, at the outbreak of the present War, was practically free from the disease. The cutaneous and pulmonary exhalations of the patients also cause the spread of the infection from person to person. The disease is endemic in Galicia and Poland, in some parts of the Balkans and Turkey-in-Asia, Egypt, Tunisia, Algeria and Morocco, Asiatic Russia, North China and Japan (occasionally), and Mexico. The disease is, on the whole, a malady of cool or temperate climates, and its seasonal activity is generally in the winter and spring months. Children, when attacked, suffer less than adults, and are not prone to die; but, over the age of 40 years, the prognosis is extremely unfavourable. *Typhus abdominalis* is enteric or typhoid fever; the true typhus is *Typhus exanthematicus* (petechial typhus).

When Germany declared war against the Allies at the beginning of August, 1914, and great masses of troops from Germany and Austria began to operate in Poland and Galicia, the disease began to spread, and made its appearance in many of the camps reserved for prisoners in various parts of Germany. The same thing has since happened in other European countries, *i.e.*, in those countries that are involved in the Great War. The British Islands have escaped up to the present, owing to their isolated and sea-girt position, and to the careful medical inspection systematically carried out in connection with all arrivals from abroad, coupled with

of the expectant mother ; consultations and clinics, together with home visiting by suitable and properly qualified health visitors ; the provision of an adequate supply of trained midwives, etc.

(c) AUXILIARY SCIENTIFIC INVESTIGATIONS (SECTION 9).

An interesting research has been carried out, dealing with the characteristics of tubercle bacilli in human bone and joint tuberculosis, *i.e.*, the human or bovine type. A total of 261 cases were examined—the patients being of different ages, and, of these 261 cases, 196 showed the human type, 55 the bovine type, whilst 10 were atypical. At age periods, the results were :—

Age-Period.				Number of Cases.	Human Type.	Bovine Type.	Atypical.
0-5	-	-	-	47	31	14	2
5-10	-	-	-	108	75	31	2
10-16	-	-	-	62	52	7	3
16-25	-	-	-	15	12	3	—
25 and over	-	-	-	29	26	—	3
Totals - - -	261	196	55	10

The large percentage of "bovine" cases amongst patients under 16 years of age is noteworthy.

(d) THE APPENDICES.

Specially noteworthy amongst the appendices are :—

- (1) A Memorandum on Health Visiting and on Maternity and Child-Welfare Centres, dealing exhaustively with the subject under the two headings of (a) home visits, and (b) attendances at a Centre—the latter being a natural development from a system of organized health visiting at home. The qualifications of a health visitor are set out, and suggestions given as to the nature and number of her visits, the routine work to be carried out at a Centre, and the accommodation at, and equipment of, such a Centre, including the nature of the records to be kept

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the incandescent gas mantle to a much lesser extent. On the other hand, the ordinary bat's wing and the paraffin flame are poor in ultra-violet rays, whilst the old-fashioned moderator, burning colza or sperm oil, gives an illumination that is almost free from such rays.

The mercury vapour light and the arc light are highly actinic, and are, in consequence, used in process-block making and other photographic operations, with the result that the workers are liable to ophthalmia electrica. Electric welders, too, suffer in a similar manner, owing to the ultra-violet rays given off from the iron carbon arc.

Prevention is simple—the wearing of *suitable* goggles. But what are *suitable* goggles? For glassworkers, the goggles must be made with glass which excludes glare and heat rays, whilst for electric welders, Polar explorers, and process-block makers, the glass used must be impervious to the ultra-violet rays. Theoretically, nothing could be simpler. In practice, however, a compromise has to be effected, on account of expense, so that goggles are used, which are not scientifically correct. A Crookes's glass is useful to exclude ultra-violet rays, but, for electric welders and glassblowers, not only ultra-violet rays but glare, too, must be excluded. A combination of a Crookes's glass and a sufficiently dense neutral glass is necessary. The compromise consists in the use of the ordinary blue or amber glass goggles of the makers.

THE PROTECTIVE EFFECT OF THE BOVINE TUBERCLE BACILLUS.

Dr. Clive Rivière has recently put forward a novel view of the question of tubercle-vaccination. Until human sources of infection can be practically eliminated, or artificial immunization becomes an accomplished fact, infection with the bovine bacillus through the use of a well-mixed milk remains our best ally in the campaign against tuberculosis! Amongst crowded communities, infection with the tubercle bacillus, whether of human or bovine source, cannot be avoided. Tuberculous lesions, and, hence, infection with the tubercle bacillus, protect the individual against further attack, whether from without or from within; whilst absence of acquired immunity renders the individual liable, at any age, to acute forms of tubercle. The bovine bacillus can

the general high standard of sanitation insisted upon in camps, billets, etc.

INDUSTRIAL DISEASES CAUSED BY LIGHT.

Dr. T. Harrison Butler has recently drawn attention to certain industrial diseases caused by light, and has suggested means for their prevention.

In many trades, the workers are exposed to light which, by virtue of its intensity or character, may cause injury to the eye. The evil effects fall into three groups:—

1. Those caused by severe glare ;
2. Those due to the action of the infra-red heat rays ;
3. Those occasioned by the ultra-violet radiation.

1. *Those caused by severe glare, e.g., sunlight (direct) or short-circuit flash.*—Central vision is much reduced, and a positive scotoma is generally present. The patients generally recover. The scotoma is caused by coagulation changes in the macula.

2. *Those due to the action of the infra-red heat rays.*—The prolonged action of great heat on the eye attacks the lens, causing a peculiar form of cataract; the opacity always begins in the pupillary area of the lens, deep down near the posterior pole, but ultimately becomes generalized. Bottlemakers are particularly prone to this disease, but other workers in molten metal or glass (e.g., puddlers) suffer in a similar manner. No X-rays and few ultra-violet rays are emitted from the surface of molten glass or metal. The light is very rich in infra-red rays, heat rays, which cause the cataract, the peculiar form of which is due to the fact that these particular rays are entirely absorbed by the iris.

3. *Those occasioned by the ultra-violet radiation.*—The ultra-violet rays cause inflammation of the lids and conjunctivæ. The rays cannot pass through the lens, but are absorbed by it, causing fluorescence. These ultra-violet rays cause snow-blindness, and an exactly similar disease called ophthalmia electrica. The mercury vapour lamp, especially the quartz mercury vapour lamp, emits a light which contains the maximum of violet and ultra-violet rays; the iron arc and the ordinary carbon arc do so to an almost equal extent, and the metallic filament lamp and

the incandescent gas mantle to a much lesser extent. On the other hand, the ordinary bat's wing and the paraffin flame are poor in ultra-violet rays, whilst the old-fashioned moderator, burning colza or sperm oil, gives an illumination that is almost free from such rays.

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afford protection, and is much less virulent to man than the human strain of the tubercle bacillus. Infection being practically unavoidable, Dr. Rivi re argues that it is only left to us to decide whether we will voluntarily present to our children the comparatively innocuous bovine bacillus, or leave them to risk a first encounter with the infinitely more dangerous bacillus of human strain.

How is the bovine bacillus to be administered? The safest and most practical method seems to be the use of a well-mixed milk, such as the large London dairy companies supply! The bacillus or its *virus* is well diluted, and the danger of massive dosage reduced to a minimum. Dosage is relative, and, as the resistance to tubercle is at a *minimum* during the first few months of life, sterilized milk during that period is suggested, to be followed, gradually, by the addition of more and more raw milk. As a corollary, it follows that complete extermination of bovine tuberculosis is not to be wished for so long as the human tubercle bacillus is rife! All that is required is to prevent the danger of massive bovine infection, but to allow an attenuated virus of tubercle bacillus (bovine) to be present in the milk supply. Certainly, a novel view!

SEWAGE DISPOSAL.

The Royal Commission has finally reported—the last or “Final Report” being dated February 11, 1915. The Commission was appointed in 1898.

The establishment of a central authority, either a separate body or a new department of the Local Government Board, is recommended, which shall be a Supreme Rivers Authority, dealing with matters relating to rivers and their purification. Rivers boards and rivers committees of county councils would be controlled by, and act under, the central authority, which would control the standard of purity to be insisted upon in any sewage or sewage effluent discharged into a stream, due regard being paid to the volume of water in the stream as compared with (1) the volume of the effluent, and (2) the purity of the stream water *above* the outfall. A “general standard” set up is as follows:—that an effluent must not contain, as discharged, more than 3 parts per 100,000 of suspended matter, and, with its suspended matter, must not

take up, at 75° F., more than 2 parts per 100,000 of dissolved oxygen in five days, in the case of a stream, neither exceptionally polluted already, nor exceptionally pure, showing a volume at least eight times greater than that of the discharge. If the dilution of the stream is very low, a more stringent standard might be necessary, and *vice versâ*. These latter would be of the nature of "special standards." Neither standard, "general" or "special," would apply to storm-water, sewage, or tidal waters generally.

How to effect, in practice, the required standard of purification is another point, and what different steps, if any, are to be taken in the case of a trade-effluent mixed with sewage is a matter of difficulty. The Report deals with these two difficult problems fully. The Commissioners definitely state that they are not aware of any case in which the admixture of trade-refuse makes it impracticable to purify the sewage upon land or by means of artificial processes, although, in certain exceptional cases, preliminary treatment may be necessary. Grit and suspended matter should be removed, as far as possible, before attempting to purify the sewage on land or through filters, and this can best be effected by quiescent sedimentation tanks, continuous flow sedimentation tanks, septic tanks, and chemical precipitation tanks.

It is noteworthy that the Commissioners speak of the purification of sewage, after sedimentation or precipitation, by filters or land treatment. Hitherto, Government departments have adopted the view that both filters and land treatment were necessary. As a corollary, it follows that there are cases in which the Local Government Board would be justified in modifying, under proper safeguards, their present official routine-practice of insisting upon the application of sewage to land as a *sine quâ non*. The immense saving, financially, that will result from this suggested relaxation of the Government rule is obvious, having regard to the present high price of suitable land, not to mention the impracticability of obtaining it in many cases of crowded localities.

Trade-effluents are to be dealt with by the local authorities, the necessary suitable sewers being provided by them for such a purpose. The manufacturers would be required to treat, preliminarily, on their own premises, the mixture

of trade-effluent and sewage, and, bring it up to standard, before passing into the sewers.

For storm-water sewage, the Commissioners recommend special stand-by tanks, thereby securing settlement of sewage prior to its discharge into a stream.

Storm-overflow sewers are not to be allowed, except in very exceptional cases; each case will be sanctioned by the Central Authority (when appointed), by rivers boards, or rivers committees of county councils. Ordinary filters should be made large enough to treat a considerable portion of any storm-water sewage that may require treatment.

Manufacturing wastes, which cannot be taken into sewers, are dealt with by the Commissioners, twenty-eight industries being specifically named as to standards of purity required, etc. Adequate reduction of solids in suspension and removal of dissolved impurities are recommended in some; in others, efficient purification is stated to be impracticable in the present state of knowledge, *e.g.*, gas and coke production and sulphite-cellulose manufacture.

Many other subjects are dealt with by the Commissioners in the *Final Report*, viz., the treatment of distillery waste, the desirability of the practice of "sludging" mill-dams being prohibited or restricted, the problem of the disposal of domestic refuse in rural areas (water-carriage *v.* conservancy systems), the dangers of pollution of tidal waters and the subsequent and consequent pollution of shell-fish layings, etc.

In regard to the last-mentioned (shell-fish layings and their liability to sewage pollution), the Local Government Board has already issued an Order, which came into force on March 1, 1915, and is known as the Public Health (Shell-fish) Regulations, 1915. The Order is issued in pursuance of the Public Health (Regulations as to Food) Act, 1907, and prohibits the sale of shell-fish likely to cause danger to the public health. Power is given to close shell-fish layings, in regard to which there is evidence to show that shell-fish from such layings have actually caused infectious or other disease, or are likely to be a source of danger to the public health. This power vests in the sanitary authority in whose district the layings are situated, with a right of appeal to the Local Government Board in particular cases. This sanitary authority *must* act on receipt of a representation from another

local sanitary authority, in whose district the shell-fish are consumed, indicating that the shell-fish have caused, *or are likely to cause*, infectious or other disease; or, on the report of their own medical officer of health, if such shell-fish be found in their own district. It is noteworthy that the Board suggests that any action taken, with a view to the closing of a suspected laying, should be based rather on epidemiological and topographical considerations than on the results of bacteriological analysis—an opinion shared by the Commissioners, who state that “the closing of a foreshore, laying, or pond should not depend, as a matter of routine, on the results of a bacteriological examination.”

The medical officer of health of any district in which layings are situated must examine the conditions of such layings, and report, as required, to his authority, all cases in which the layings are so situated as to be liable to dangerous contamination, so that steps may be taken to prevent shell-fish from such suspected layings being distributed for sale for human consumption, unless and until the shell-fish have been relaid in fresh water for a period of time sufficient to free them from contamination—not less than fourteen days.

COMPULSORY NOTIFICATION OF MEASLES AND GERMAN MEASLES.

The Local Government Board has, at last, taken the plunge, and issued an Order, by which, from January 1, 1916, measles and German measles became compulsorily notifiable. Theoretically, notification is necessary, so that sanitary authorities may know the number of the enemy to be attacked and his whereabouts. In practice, however, judging by the experience of certain sanitary authorities, which have already tried compulsory notification, the results have not proved satisfactory, owing to the extremely infectious nature of the disease during the *prodromal* symptoms, the difficulty in diagnosing the disease in its early stages, the age-period of the patients generally affected, and the consequent impossibility of securing proper and efficient isolation, *e.g.*, in hospital, etc. Despite these objections, the Board has decided to give notification a trial, if only with a view to drawing attention to the dangerous nature of measles and German measles, and the folly of belittling them as diseases “to be got over, and the sooner the better”—an opinion

generally held by parents and others. Measles causes, annually, a large number of deaths, and a large amount of ill-health and permanent injury amongst the very young, so that the subject of its prevention has an important bearing upon the question of infantile mortality.

The Order applies to England and Wales, and, under it, there is a dual notification imposed, viz., (1) upon medical practitioners, and (2) upon parents or guardians or other persons in charge of the patients. A medical practitioner is not required to notify, if a previous case of the same disease has been already notified in the same household or institution during the preceding two months. Medical assistance, including nursing, etc., for the poor, suffering from measles or German measles, can be provided by local authorities under the Order—an important provision, for careful nursing is essential. Having regard, however, to the great fluctuations in the numbers of cases of measles and German measles occurring at any one time in a district, and the consequent lack of necessity for the appointment or continuous employment of nurses, it is suggested that the nursing of such cases in their own homes should be entrusted, as far as possible, to the existing nursing organizations, under the supervision of medical men, though many cases must occur in which no medical men will be called in. Hence the special statutory powers given under the Order, by which, subject to the consent of the Local Government Board, sanitary authorities are enabled to spend money out of the rates for the provision of medical or nursing assistance for the poorer classes of their districts. The matter of nursing is, at present, under consideration by the associations for district nursing, and other bodies or persons interested. There can be little doubt but that, under these conditions laid down by the Local Government Board, *i.e.*, with the help of an organized nursing staff, many of the deaths from measles and German measles will be prevented, and much good obtained from the compulsory notification of these diseases. Similar arguments apply to whooping cough, which is equally a danger to the health of young children, directly or indirectly. Future statistics will show:

RECENT WORK IN TROPICAL DISEASES.

By R. TANNER HEWLETT, M.D., F.R.C.P.

Lecturer on Bacteriology, London School of Tropical Medicine; Physician to the King George Hospital, etc.

BILHARZIA DISEASE.

ONE of the most important contributions to tropical medicine published since the last "review" in these columns* is the Report¹ of the Bilharzia Mission of the War Office in Egypt, 1915, under the direction of Temporary Lieut.-Colonel Leiper, of the London School of Tropical Medicine, with whom were associated Drs. Cockin and J. G. Thomson, of the same School. Bilharziosis, schistosomiasis, or endemic hæmaturia was first recognized as being caused by a bi-sexual distome by Bilharz in 1851. Various observers subsequently sought for an invertebrate intermediary without success, and Looss finally adopted the view that the parasite reaches man direct; Leiper gives a very complete summary of all these earlier researches.

During 1911-1913, Japanese investigators had succeeded in infecting cattle, cats, and dogs with an allied disease, caused by *Schistosoma japonicum*, by immersing the animals in the flooded fields of infected areas, but had quite failed to obtain infection by similar immersion in water containing large numbers of live miracidia, suggesting the existence of a molluscan intermediary.

Leiper and his colleagues, therefore, first proceeded to collect and determine all the fresh-water molluscs in a selected endemic area within half a day's journey of Cairo, and to search for trematode larvæ in as many of these as possible. Bilharzia cercariæ were eventually found in two species, *Bullinus* (sp.) and *Planorbis boissyi*, and experiments showed that the cercariæ would penetrate the skin in mice and rats, so that infection may take place by the skin. Infection can also occur by the mouth, for monkeys fed with water

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Various experiments were made on the conditions of life of the cercariæ and on the action of germicidal agents upon them. Once the cercaria has entered the definitive host, it undergoes no further metamorphosis. There is a gradual growth, with differentiation of organs, and with differentiation of male and female individuals. The route taken by the cercaria, in its transit from the skin to the portal system, is still under investigation; it may be that a certain number enter the blood-stream direct, while others pass first through the lymphatic system.

The following are some of the conclusions and recommendations arising out of this work:—

- (1) Transient collections of water are quite safe after recent contamination.
- (2) All permanent collections of water, such as the Nile, canals, marshes, and birkets, are potentially dangerous, depending upon the presence of the intermediary host.
- (3) The removal of infected persons from a given area would have no effect, at least, for some months, in reducing the liability to infection, because the intermediate hosts discharge infective agents for a prolonged period.
- (4) Infected troops cannot re-infect themselves or spread the disease directly to others. They could only convey the disease to those parts of the world where a local mollusc could efficiently act as carrier.
- (5) Infection actually takes place both by the mouth and through the skin. Recently contaminated moist earth or water is not infective.
- (6) Infection in towns is acquired from unfiltered water, which is still supplied, even in Cairo, in addition to filtered water, and is delivered by a separate system of pipes.
- (7) Eradication can be effected without the co-operation of infected individuals by destroying the molluscan

intermediaries.

Unfiltered water taken from canals, ditches, or birkets would be rendered safe:—

- (1) If kept beyond the survival period of the cercaria, *i.e.*, for forty-eight hours.
- (2) If heated to 50° C., a temperature at which the cercaria is immediately killed.
- (3) If previously treated with those chemicals that are lethal to the cercaria.

The chemical sterilization of water is chiefly effected by the use of (a) sodium bisulphate, and (b) chlorine. These two substances react upon cercaria very differently, in the strength at which they are more commonly used for the destruction of bacteria in water.

(a) Sodium bisulphate is used in "tablet" form to sterilize water for drinking purposes. Two "tablets" are dissolved in a quart water-bottle, as a rule. Each "tablet" contains 16 gr. (1 grm.). This gives a dilution of 1 in 567. It has been shown that a dilution of 1 in 1,000 is quickly lethal to the bilharzia cercaria. These "tablets" may, therefore, be used with safety in bilharzia-infected countries.

(b) The germicidal value of chlorine for bacillus coli, according to Captain Nesfield, is 1 in 760,000 acting for ten minutes. 1 in 1,000,000 acting for half an hour is in common use. There is one part of available chlorine in three parts of fresh chlorinated lime. One part of chlorinated lime in 300,000 with half an hour's contact is, therefore, an efficient bactericide. From tests of the effects of chemical reagents on the cercaria, it was found that this dilution would not have the slightest effect upon the activity of the bilharzia cercaria. It would be necessary to use twenty parts of bleaching powder per 1,000,000, and afterwards to dechlorinate in order to render water taken from the canals and ditches in Egypt free from bilharzia infection.

Attention should be given to the following points:—

- (1) Personal contact of any kind with unfiltered water is risky. The surface of the water is the most likely to be infective, for the cercariæ congregate there. An intake pipe should always be led,

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hydroquinine was found to be most effective, and quinoidine the least; cinchonine, quinine, and quinidine less so, but of about equal value. It would appear that the minimal lethal doses for the vulnerable stage of the benign tertian, malignant tertian, and quartan parasites are, respectively, about 0.1, 0.15, and 0.2 gram per 70 kilogram. of patient's weight.

Barber, Raquel, Guzman, and Rosa,⁴ in a survey of malaria in the Philippines, find that the commonest species of *Anopheles* are: *A. rossii*, *A. febrifer*, *A. barbirostris*, *A. maculatus*, and *A. sinensis*, and of these *A. febrifer*, and, to a less extent, *A. maculatus*, are the chief transmitters of malaria in the Philippines. *A. febrifer* is a stream breeder, and its destruction by means of larvicides is probably a practical anti-malarial measure in these islands.

CHOLERA.

Sir Leonard Rogers⁵ reports a further reduction in the mortality of cholera, to 11 per cent., by the addition of atropine hypodermically to the hypertonic salt and permanganate treatment. The following are the principal points in his present system of treatment:—

On admission, give one-hundredth of a grain of atropine sulphate hypodermically, and repeat it morning and evening. Take the specific gravity of the blood, the blood-pressure, and the temperature in the mouth and rectum. If the blood-pressure is not over 70 mm., or the specific gravity is 1063 or over, give an intravenous injection of sterile hypertonic saline, of three, five, or even six pints, in accordance with whether the specific gravity is 1063, 64, 65, or 66 and over in male adults, and correspondingly less in females and children in proportion to their approximate weights. Unless the rectal temperature is below 99° F., the saline should never be injected at above blood heat (98) for fear of producing hyperpyrexia. If the rectal temperature is 100° F., or over, the fluid should be given at a temperature between 80 and 90 F. The hypertonic solution should contain 120 grains (8 grams) of sodium chloride and 4 grains (0.4 gram) of calcium chloride. Potassium permanganate is to be given in two-grain pills, made up with kaolin and vaseline, and, preferably, coated with salol or keratin; two pills every quarter of an hour, for two or four hours, according to the severity of the

therefore, to the centre of the stream, and should draw the water from near the bottom and at a place where there is little or no vegetation.

- (2) It is essential, in drawing water for storage, in order to destroy the bilharzia cercaria, that no infective mollusc be admitted. This can be insured by screening the intake pipe with gauze, having about sixteen meshes to the linear inch. The common mosquito gauze or phosphor-bronze wire gauze is very serviceable.
- (3) The water in the wells and "sakias" may be regarded as much safer than that from other sources. Hitherto molluscs have not been found in these wells.
- (4) Shallow barrel sand-filters are open to suspicion. It has been found, experimentally, that after fifteen minutes cercaria succeed in passing in large and increasing numbers through four inches of desert sand.
- (5) Although the reproductive activity of bilharzia in the molluscs is probably most intense during the summer months, the occurrence of mature cercariæ in infected molluscs, in February, shows that there is a certain liability to the infection throughout the year.

Leiper² discusses the relation between the terminal-spined and lateral-spined eggs of Bilharzia. He finds that there are distinct differences between the worms producing these two kinds of eggs. The molluscan hosts are different; in the adult males, the testes in the former are four or five, and large, and in the latter, eight or nine, and small, whilst there are differences in the cercariæ of the two forms. It may be remembered that Sambon separated the two forms under the names *Schistosomum hæmatobium* and *S. mansoni*.

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carriers as a scientific prerequisite.

The following figures are given by Schöbl⁶ of the time during which cholera patients may be infective, based on the examination of 80 patients:—

Stools positive.	Patients.
For from 2 to 7 days - - -	43
For from 7 to 14 days - - -	22
For from 14 to 21 days - - -	6
For from 22 to 28 days - - -	5
For 48 days - - - - -	1

The vibrio was found in the gall-bladder in 17 cases out of 39. Forty-one examinations of the urine of 27 patients and convalescents, whose stools contained cholera vibrios at the time of examination or some time previously, were all negative.

Greig⁷ has described various lesions of the gall-bladder and biliary passages in cholera, and has now observed the occurrence of gall-stones in rabbits treated by injections of cholera vibrios. This experimental observation may throw some light on the question of the formation of gall stones in the human subject, a lesion which is frequently met with in Calcutta.

DYSENTERY.

The Advisory Committee for the Prevention of Epidemic Diseases in the Mediterranean Expeditionary Force have issued a useful series of recommendations on the treatment of diarrhœa and dysentery,⁸ of which the following is a summary:—

(a) *Dietetic*.—In every instance the diet should be liquid. For the first 24 hours, milk should be avoided and barley, rice, oatmeal, or albumen-water or chicken broth given. Afterwards milk may be given, preferably diluted with water or barley-water, and a little sodium citrate (three to five grains to the pint) added. If milk cannot be tolerated, Benger's food, Brand's essence, bovril, and light soups may be substituted. No solid food should be given until the active processes in the bowel subside, when arrowroot, custards, etc., should be added with due caution.

(b) *Medicinal*. (i) *Diarrhœa*.—A case seen quite at the beginning should at once be given an ounce of castor oil; if colic be present, 10 minims of Tr. Opii should be added to

case, and then two every half-hour until the stools change to green or yellow, and become comparatively small. Barley-water and plain water, by the mouth, in small quantities at a time (three to four ounces) should be given frequently, but no other food during the attack. Half a pint of normal saline (sodium chloride, 90 grains to the pint) must be given by the rectum, until the collapse stage is passed and urine is being excreted regularly; it is then reduced in frequency to every four hours, and continued until two pints of urine are passed in the twenty-four hours.

The fall of the blood-pressure to 70 mm. and under, or the rise of the specific gravity to 1063 or above, is an indication for the repetition of the intravenous injection, estimations being made regularly, morning and evening, and at any time that the pulse tends to fail or the patient becomes restless. At each repetition of the injection, and at the first injection in all cases admitted late with suppression of urine for twenty-four hours or more, one pint of the following alkaline solution—sodium chloride, 60 grains, and sodium bicarbonate, 160 grains—is given, and the ordinary hypertonic solution is continued up to the total amount indicated by the specific gravity of the blood.

If the urinary excretion is deficient in the later stages, with a blood pressure of 100 mm., or more, and a specific-gravity of below 1063, but not much below the normal point of from 1056 (in Indians) to 1058 (in Europeans), one pint of the above alkaline solution is given, either subcutaneously, or, better, intravenously, to increase the urinary flow. The alkaline solution should be given by the rectum as well in such cases, instead of the normal saline.

If the blood-pressure remain persistently below 100 mm., and urine is deficient, pituitirin is given hypodermically and caffeine sodio-salicylate, in five-grain doses by the mouth, every four hours, and dry cupping and fomentations are applied over the lumbar region repeatedly. In very young children and feeble old adults, glucose may be given in the rectal saline, to support the strength.

With regard to a cholera outbreak in Manila, Munson remarks that carriers would seem to be not only the most numerous, but the most insidious and dangerous sources of infection. The prompt eradication of a general cholera infection, therefore, includes the detection and isolation of

In severe amœbic dysentery, emetine should be given intravenously. As much as one and a half grains can be injected daily, dissolved in 10 cc. of saline. The drug should be diminished as the case improves; if emetine is going to do good, its beneficial action is quickly apparent. Failing emetine, the old ipecacuanha treatment must be resorted to.

During convalescence, bismuth salicylate should be employed if diarrhœa persist. In all severe cases, the tendency to heart failure should be borne in mind. When the condition becomes chronic, local treatment is most useful, such as large enemata of copper sulphate (1-1000) or silver nitrate, with starch and opium.

(3) *Bacillary Dysentery*.—When the disease is recognized, bacteriologically or clinically, as being bacillary, anti-dysentery serum should be given, if available. If salines are employed, the sodium sulphate mixture, mentioned above, will be found to act well. In very bad cases, drained by incessant evacuations, intravenous injection of saline on the lines introduced by Rogers, for cholera, will often save life, *but it must be resorted to in good time*.

When the disease becomes chronic, local treatment, similar to that employed in chronic amœbic dysentery, is indicated.

In cases of doubtful ætiology, a combined therapy of emetine and polyvalent serum should be employed.

In all forms, colic is benefited by turpentine stupes to the abdomen, and hæmorrhage may be controlled by morphia and adrenalin hypodermically, calcium chloride or lactate by the mouth, or oil of turpentine in capsules.

(4) *Flagellate Dysentery*.—*Trichomonas hominis* is the only parasite causing diarrhœa or dysentery which can be satisfactorily treated. In the early stage, an enema of boiled water should be given, followed by one of iodine (1-1000), given very slowly every evening for three consecutive days.

If the parasites persist, a tablespoonful of the following mixture should be given every two hours for three days:—

R	Infusi Cinchonæ (1 in 50, not acid)	-	℥iiss.
	Extracti Cinchonæ -	-	℥iij.
	Tincturæ Cinnamomi -	-	℥v.
	Syrupi Opii (0.5 ext. in 1,000)	-	℥iiij.
	Tincturæ Camphoræ Compositæ	-	℥j.
	Olei Terebinthini -	-	℥ xlviij.

the oil. This, with rest, warmth and a suitable dietary will often check the condition. It may frequently, with advantage, be followed by one drachm doses of castor oil in emulsion, every four or six hours for 24 hours. At the same time, to be on the safe side, emetine should be given from the onset—two-thirds of a grain once or twice a day. In severe cases, which show every sign of passing into true dysentery, larger doses of emetine should be given—two or even three grains in the day, in half-grain doses, every four or six hours.

If the castor oil fails after fair trial, salines should be given. The following is a useful prescription:—

R.	Sodii Sulphatis	-	-	-	gr. lx.
	Acidi Sulphurici Aromatici	-	-	-	℥ xv.
	Tincturæ Zingiberis	-	-	-	℥ vii.-viii.
	Aquæ Menthæ Piperitæ	-	-	-	℥ i.

This may be given every two, three, or four hours, according to the severity of the symptoms, and should be continued until the stools become watery.

(2) *Amœbic Dysentery*.—When bacteriological examination of the clinical symptoms indicates that entamœbæ are the cause, emetine treatment should be pursued energetically. A dose of one grain given once or, at most, twice a day, preferably hypodermically, is usually ample; but it must be remembered that emetine kills the amœba and prevents the formation of its infective cysts, and has no action on the ulcerative colitis. Local treatment of the bowel is, therefore, generally indicated. For this purpose, the saline mixture mentioned above may be given four-hourly, together with a saline enema douche, night and morning. Later on, when blood has disappeared but mucus still persists, daily enemata of tannin and quinine should be substituted—150 grains of tannin and 15 grains of quinine in one pint of warm water. If painful, half strength may be employed. Tannin alone (0.5–1.0 per cent.) may be used, and calcium permanganate, six grains or more to the pint, is an alternative solution. A sedative enema, consisting of bismuth, two drachms, tincture of opium, 30 minims, and thin starch, two ounces, is sometimes useful. Warm linseed tea also forms a soothing injection. A suppository of cocaine and morphia will frequently facilitate the administration of enemata, and may benefit spasm and tenesmus as well.

monovalent vaccine is used. When vaccines, containing more than four species, are given, the results are generally not satisfactory, protective substances developing for only two or three species and suddenly disappearing. The combined vaccines now used consist of carbolized emulsions of agar cultures, in saline solution, prepared without heating, 0.5 per cent. carbolic acid being sufficient to kill the germs. The use of such polyvalent vaccines should obviously much simplify the problem of multiple immunization.

TYPHUS FEVER.

Topley¹⁰ reports the results of a bacteriological investigation of typhus fever during the Serbian epidemic of 1915. Some thirty cases were investigated, by films and cultures of the blood, and cultures of the cerebro-spinal fluid and urine. The blood-films showed the usual leucocytosis and the high percentage of large mononuclear cells, which have been observed by previous investigators. In the majority of thick blood-films, a varying number of micro-organisms was present—cocci and short bacilli, and generally a long fusiform bacillus. The same kind of organisms were, however, found in control specimens, taken from cases other than typhus, showing that it is impossible sufficiently to free the skin from micro-organisms for preparations of this type to be of value. The cultures from the blood were made in broth, agar, blood-agar, ascitic fluid broth, and kidney-tissue ascitic fluid agar (method of Noguchi). In the last-named, a cloudiness appeared after fourteen days' incubation, and microscopical examination showed the presence of minute coccal or bacillary organisms, which were very difficult to stain, but the organism failed to grow in sub-culture. In the broth and ascitic fluid cultures, a growth of a Gram-positive, diplococcal organism was obtained in every case. Sub-cultures were obtained on various media, a striking characteristic of the organism on all media being its pleomorphism.

It may be useful to mention the results obtained by other observers. Wilson, in 1910, obtained Gram-positive diplococci in fifteen out of thirty-three cases. Rabinowitsch, in 1909, isolated from the blood a short bacillus, with rounded ends and showing some degree of polar staining. Predtjetschensky, Fuerth, and Müller also isolated similar organisms. Hort and Ingram, in 1914, examined the blood in twenty-two cases of

With—

Gummi Acaciæ	-	-	-	-	3ss.
Aquæ Floris Aurantii	-	-	-	-	3ss.
Aquæ Distillatæ	-	-	-	-	3v.
Syrupi	-	-	-	-	3ij.

In addition, the following enemata, night and morning, are indicated :—

- (a) 3½ pints of decoction of eucalyptus.
- (b) 2 ounces of boiled water, yolk of an egg.
10 minims of laudanum.
- 15 „ „ essence of turpentine.

The Committee insist on the need for absolute rest and warmth to the abdomen in all cases of dysentery and diarrhoea, and the value of careful washing of the stools and search for sloughs.

TYPHOID VACCINATION, ETC.

Castellani⁹ has advocated, in several papers, the use of mixed vaccines for preventive purposes. These may be combined :—(a) typhoid + paratyphoid A + paratyphoid B, (b) typhoid + paratyphoid A + paratyphoid B + cholera; (c) combined vaccines, containing various dysentery bacillus; (d) plague + cholera + typhoid + paratyphoids, and such a mixture as (e) cholera + plague + typhoid + paratyphoid A + paratyphoid B + Malta fever. The combined vaccines contain fewer organisms of any one species of bacterium than a single vaccine, but Castellani claims that just as good immunization is obtained, and that the reaction is but little more severe than when a single vaccine is employed. Thus, vaccine (a) above contains 500 millions typhoid, and 250 millions each of the two paratyphoids, and a dose of 0·5 to 0·6 cc. is given for the first dose, and 1·0 to 1·2 cc. for the second dose; vaccine (b) is similar to (a), but contains 1,000 millions cholera in addition, two doses of 0·5 cc. being given. The last-named was prepared in Serbia, on a large scale, and more than 170,000 men were inoculated, with good results.

The vaccines containing plague are the only ones in which the reaction is at all severe, but the monovalent plague vaccine frequently gives a severe reaction. The vaccines which contain two, three, or four species of bacteria generally produce agglutinins for each species, and the amount of agglutinin for each species is not much less than when a

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RENAL EXCRETA: AN EXAMINATION OF SOME FALLACIES AND FACTS.

By EDWIN WOOTON.

IN health, the renal output is not a physiological constant, either in quantity or composition. Renal functions are reciprocal to variations in endogenous and exogenous metabolism, the activity of the skin, and that of the intestines.

Variations in food quantities, food qualities, external thermal conditions, work, both muscular and nervous, and in the amount of fluid discharged by the bowels result in quantitative composition varying, and this connotes that the water of the urine is subject to fluctuation as well. Any conclusions based on a urinary analysis, without reference to the influence exercised by such potentials, must tend to be fallacious. If right, they are so by pure luck; the openings for the intrusion of error are many.

The only real norm of urine is qualitative. Of the many abnormal constituents, the chief are sugar, pus, mucus, blood, hæmoglobin, alkapton, chyle, peptones, albumen, cystin, tube casts, and certain parasites. Such additions are absolutely pathological. The first fact that a student of urinology would do well to grip, is the relationship of the kidneys to the skin. They have a swaying vicariousness of function, not only with regard to water, but uric acid.

The skin excretes only a trace of uric acid as such. It, however, secretes and excretes other acids largely. Freedom in their output always means the lessening of the blood's uric acid content. The "how" is an unsolved problem, but these facts are indubitable:—A degree of cold that reduces skin secretion to the negligible point, will frequently result in gout, when the gouty tendency obtains. It may not seize on a joint. If it attack the skin, we see a dry eczema, with a powdery deposition of urates. Free perspiration and warmth quickly bring such a skin to the normal state. Moreover, given other equal conditions, the gouty sufferer

typhus fever in Ireland, and obtained cultures of diplococcal and diplobacillary organisms, similar to those described above. They also noted, in fresh specimens of the urine, the presence of minute organisms, sometimes coccal, sometimes bacillary in form, and sometimes Gram-positive, sometimes Gram-negative. Finally, Plotz, using Noguchi's method of cultivation, obtained a small, pleomorphic, Gram-positive bacillus.

It will be seen from this review that there is a general similarity in the results obtained by these different observers in the bacteriological in cases of typhus fever, though whether the organism found is that causative of the disease must still remain doubtful. It is to be noted that the fairly constant incubation period of the disease, its conveyance by the louse, and the large mononuclear increase, are all points suggestive of a protozoan causative agent.

VERRUGA PERUANA.

Townsend¹¹ discusses this disease, and brings forward evidence of its transmission by insects. He believes that the ordinary verruga and the more severe Oroya fever are but two stages of one and the same disease. He comes to the conclusion that the disease is conveyed by a new species of *Phlebotomus* (*P. verrucarum*).

Townsend¹² also believes that lizards are the natural reservoirs of the "Bartonia" bodies present in the red-blood corpuscles in Oroya fever, and supposed to be the parasite of the disease, being transmitted by the *Phlebotomus* from the lizard to man.

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- ¹² *Science* Vol. XL., p. 212.

liver changes the greater part of this acid into urea. Of the residual acid, an approximate moiety becomes converted into sodium quadriurate; the remainder circulates as free acid.

The nucleo-proteins run a very similar course, but only after a long and complex series of hydrolyses and oxidations. We will just glance at these.

An intracellular enzyme, called nuclease, breaks down the nucleo-protein into protein, phosphoric acid, and nuclein bases. The first two are potentially useful. The nuclein bases, called, also, purin bases, are four in number. In common, they contain the chemical principle— $C_5 N_4$ —which, on oxidation, yields two molecules of urea. All these bases become successively xanthin, and uric acid.

On the other hand, we may liken exogenous katabolism to the inspection of proffered nutriment, the acceptance of the usable, and the transformation of the unfit partly into excretable, and partly into nutrient stuff. Only the protein derived from nucleo-protein is useable in building up tissue; the purins pass straight away to the uric sequence of changes.

It is not implied, for one moment, that in the vast metabolic labours of the system these simple lines of action exhibit all the sources of the uric series. Let it suffice that an overwhelmingly large proportion of the body's uric acid is of nucleo-protein origin, endogenous, and exogenous.

However interesting to the biologist, many of the details, actually, or supposedly, concerned in metabolism, have little immediate bearing on the practical problems daily confronting the medical man. It does not help him to be told there are three, or three hundred stages of elaboration in egesta or ingesta. But he is helped very considerably by the broad principles deducible from, or that may be common to, a host of particulars. If one reads a bio-chemical classic, one will see all stages of katabolism and anabolism beautifully set forth in formulæ; and one may close the book with the impression that at each stage so much material could be neatly packed, labelled, and placed on a shelf in its due position relative to all other packages.

Without being hypercritical, I think matters are somewhat different. The bio-chemistry of a potato is one thing, that of an animal organism is very much another. Examinations of cadaveric flesh have revealed a lot, but absolutely only

is always freest from attacks when the skin is functionally active. It is no argument to urge that in certain cold climates gout is rare. Under habituation to the special thermal condition, there is, probably, quite as great a renal adaptation for the removal of the uric series as there is for the removal of water.

The skin-acids are skin-products, and are not normal to the blood. Uric acid is a normal content of the blood, and it is difficult to avoid the belief that the cutaneous glands seize on uric acid itself, or on some antecedent or educt of it, making it into one or other of their own excreta, perhaps more than one. As intimated, the "how" is a problem, but the vicariousness of action is solid fact. In seeking indications of health-conditions from urinary analysis, we have to take into account the possibility of the personal urine-norm having been modified by solid or liquid food, by brain-work, nerve-strain, or muscle-work, by skin-output, or by any special action of ingesta on the kidneys or their secretion.

To illustrate this:—Urine concentrated by the profuse outpouring of sweat may be turbid on passing, or soon thereafter, and may be deeply coloured, yet, in all respects, a perfectly healthy urine; that is, such characters, under the condition mentioned, indicate nothing contrary to physiological law, however apprehensive they may make the medical attendant of cystic or renal ills in the future.

The broad relationship of the renal discharge to the body content may be summarized thus:—Endogenous katabolism casts into the blood stream carbonic acid, water, sarcolactic acid, kreatin, kreatinin, and nucleo-proteins. The exit channel of the first is by the lungs; that of the second is by the kidneys; the third is split up. If not split up, it causes the train of pathological conditions called rheumatic, its chief morbid power being that of seizing on calcium, and depositing it in effete cellular material. The renal output tells us little, if anything, of these activities. It is with the kreatin, the kreatinin, and the nucleoproteins of the endogenous katabolism that urinology is chiefly concerned. Kreatin and kreatinin come from protein, and find their sequence of changes mainly, if not exclusively, in the spleen and liver. The spleen transforms them into uric acid. The

from muscular work?

Has it been brought about by the over-ingestion of purin-bearing foods?

So far as his daily work is concerned, the medical man has a more immediate interest in exogenous than endogenous purins. They are taken thus:—Methyl purins in cocoa, tea, and coffee; free purins, as xanthin and hypoxanthin in meat extract; bound purins in many animal and vegetable foods. Practically, there are *no* purins in wines, spirits, strawberries, eggs, milk, cheese, butter, sugar, white bread, rice, tapioca, cabbage, cauliflower, lettuce, or macaroni. When present in any of these, the percentage is so small as to be negligible.

Purins, in small percentage, are always found in potatoes, onions, oatmeal, turnips, peas, beans, carrots, parsnips, rhubarb, asparagus, sea-kale, dates, figs, spinach, sole, cod. Foods rich in purins are:—sweetbread, lean veal, mutton, beef, pork, chicken, plaice, salmon, halibut. Hence, it may be understood that an ill-constructed dietary may itself be responsible for a condition of renal excreta that, from analysis of the urine, without reference to other facts, one might ascribe to a faulty metabolism.

Urine Colour.—The urine contains two chief pigments. One, deep yellow and the more abundant, is urochrome; the second, present always, but in smaller quantity, is urobilin; it is of reddish hue. A third pigment, pinkish, is in such small amount as to be of little importance.

Given two equal quantities of urine, passed under similar dietetic and exterior thermal conditions, then variations in colour will point to variations in pigment quantity. Urine contains as well bodies termed chromogens; these, by undergoing oxidation, deepen the yellow colour after some hours' exposure to the air. The physiological antecedent of urochrome is protein. Increase is compatible with health when its presence is due to muscular work, or to large protein intake. Under any other conditions, the accompanying katabolism is pathological. As normal urine deepens in pigmentation directly as its state of concentration, this deepening is inverse to the freedom of the skin discharge. An individual in perfect health, doing much muscular work in a warm temperature, may perspire so profusely that the

with reference to cadaveric flesh. In some details, it has been possible to obtain confirmation or disproof of prior conclusions from living flesh, but—to speak quite honestly—the chemistry of the human body is very largely a synthetical science, the particulars of which are merely approximate varieties. But it has its certainties, and, very fortunately, it is only these that are of immediate medical importance. Amongst them are : the necessity of free oxygen intake for preparing waste for removal, and for obtaining from waste usable by-products, as water and protein ; the great importance of the liver as a laboratory for the production of urea ; and the differences in character of various foods relative to the waste they furnish. Urinology bears directly on these truths, and helps to reveal any deviation from the norm.

Let us assume that, at any moment in the life of a human being, the body has its healthy content of urea, sodium quadriurate, and uric acid. Two breaches of the metabolic laws I have sketched are now possible ; the uric acid may not be changed into urea to the extent normal—that is a liver fault. The second possible breach is, that the quadriurate—a highly soluble salt—may take up another atom of base, so becoming the biurate, a salt comparatively insoluble. It has become the fashion to speak of uric acid as if some systems possess an excess power of forming it. If such a power ever does obtain, it must be rarely. The supposition is at variance with all reliable teaching as to the sources of uric acid. This acid is but equationed to a definite percentage of used-up body substance, and ingested material. I have searched vainly for any proof of such excess power, but I have found abundant evidences of excess and unsuspected supply of the acid's antecedent, and of comparative non-use of the normal physiological means by which the acid is removed, or altered.

When the practical medical man finds in any case that the systemic uric acid is excessive, he should investigate these points :—

Is the condition owing to the blocking of the vicarious skin-output by cold ?

Is it a consequence of the liver failing to make a normal quantity of urea from the acid supply ?

Is it due to an excessive outpour of nucleo-proteins

taking any preparations of phosphorus. Children pass more urea than adults, relatively to body weight; the endogenous metabolism is always greater in childhood than in adult life. The normal output of urea has a wide limit. It is more constant for the individual than for the race. Some persons excrete 22, others as much as 36 grams daily. The percentage, by weight, ranges from 1.4 to 3. Very usual factors, other than those considered, in urea increase are cold bathing, hot baths, breathing exercises, and the internal use of sulphuric acid, phosphorus, arsenic, antimony, and morphia.

Great muscular activity results in an increase of the uric series, more especially—it is affirmed—in the form of urates. As a rule, the discharge does not begin until the expiration of three hours from the time of work, and it may last twenty-four hours. The katabolic excreta are always greatest in those unused to the work. Training, or use, opens up avenues, other than renal, for much of the waste. It is not rare to find a great and prolonged muscular effort, by an untrained person, result in an increase of temperature, and other febrile symptoms, quite outside the norm, and therefore, pathological. Such a state may last several days.

Turbidity.—Turbidity of urine on passing may be physiologically innocent—an effect of concentration, or alkalinity, or of both; but in saying this, I do not minimize its possible dangers. The urates thrown down because of concentration are usually fawn-coloured. White urates are seldom physiological; they are associated with digestive disturbance. An excessive output of fawn-coloured urates is frequently a consequence of great muscular work; it may result as well from a high protein intake.

Examination.—Not more than two hours should elapse between the time of being passed, and the examination. Fallacies may result from testing stale urine. Despite Sir Michael Foster's teaching, that free acid is never found in the renal output, I think most observers will agree with me, that free uric acid is a normal urinary constituent. Stale urine undergoes ammoniacal decomposition, and, being acted on by the acid, throws down urate of ammonia. Physiologically wholesome urine contains a mere trace of ammonia. The only normal salt of uric acid is quadriurate of soda. That is very soluble; hence, any downfall of urates should

urine has a brown colour.

Many drugs affect the colour of urine. Logwood makes it reddish; santonin, a bright yellow; rhubarb, and senna a brownish yellow. Creosote, internally or externally, darkens the urine. Tar has a very similar effect. Carbolic acid gives urine an olive green shade, although, as a rule, the change does not appear until some hours after passing.

Alkaptonuria, as a distinctly pathological condition, need not be discussed.

Quantity.—There is no physiological standard. An average is an absurdity, for it abolishes individual differences. External temperature, intake of fluid, output of water by the skin, diet, and body weight affect the quantity so markedly, that it may be as low as ten ounces, or as high as one hundred in the twenty-four hours. The physiological rule is:—Find the personal norm. If there are deviations from this, consider the possible obtainance of thermal or other innocent causes. Diet often has a decidedly stimulating action on the kidneys: oranges, lemons, apples, pears, grapes, pine apple, and rhubarb contain various salts, acid or alkaline, and, in some cases, free acids. These are powerfully diuretic.

Reaction.—The urine of mixed feeders is acid, due, chiefly, to acid sodium phosphate. Urine may become alkaline during digestion. A physiological see-saw is set up between the kidneys and stomach; an acid output by the stomach lessens that discharged by the kidneys, although the acids are dissimilar. The urine of vegetarians, and, more especially, of large fruit eaters, tends to the neutral, or alkaline; the ingested salts, and acids being converted into alkaline carbonates in the system.

Specific Gravity.—This is usually given as from 1015 to 1025. It may sink to 1002 from copious drinking, or dietetically stimulated renal action. It may rise to 1035 in urine concentrated by profuse sweating. Differences in specific gravity are of no value as indicating departures from physiological law, unless found to obtain under identity of dietetic, thermal, and intestinal conditions.

Variations in Percentages of Solids.—As pointed out, carbonates may be greatly increased by diet, without any pathological significance. Oxalates may result from eating salads into which sorrel enters. Phosphates are increased by

taking any preparations of phosphorus. Children pass more urea than adults, relatively to body weight; the endogenous metabolism is always greater in childhood than in adult life. The normal output of urea has a wide limit. It is more constant for the individual than for the race. Some persons excrete 22, others as much as 36 grams daily. The percentage, by weight, ranges from 1.4 to 3. Very usual factors, other than those considered, in urea increase are cold bathing, hot baths, breathing exercises, and the internal use of sulphuric acid, phosphorus, arsenic, antimony, and morphia.

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lead one to test for the insoluble biurate. It should be kept in mind that gelatinous forms of the biurate are sometimes found. These are more soluble than the crystalline. As they dialyse, they are probably hydrated salts. Urates are deposited from acid urine only; but ammoniacal decomposition is quite compatible with a downfall of urates, because of the fact already stated—the seizing of the ammonia by free uric acid.

Albumen.—This may be in the form of hemi-albumose. It is not coagulable by heat.

Sugar.—Moore's test is quite worthless unless the urine is pale, and has been proved free of albumen. If there is albumen, it must be separated by filtration, after coagulation by heat. The presence of albumen would vitiate the test. It is also necessary to remove albumen before using any test into which copper enters, for albumen will prevent the precipitation of the oxide.

Another fact worth keeping in mind is, that glyconuric acid ($C_6 H_{10} O_7$) is sometimes present in urine that is not diabetic. This will precipitate the copper oxide, and may be wrongly set down as sugar. To distinguish between the acid and sugar, add to some of the urine a little yeast, and invert the test tube in urine. Glyconuric acid does not ferment, so no displacement of urine will occur by evolved gas. Perhaps it may also be forgiven me if I remind the medical man, that recent chloroform inhalation will reduce the copper oxide, and that salicylic acid, taken medicinally, acts similarly. Chloroform is sometimes employed as a preservative of urine. Drugs should never be used for this purpose. The only legitimate antiseptic for any material to be placed under analysis is *cold*. Thymol may persuade the observer that he is dealing with bile.

I could write a great deal more on a subject that is not only of interest, and of practical importance in itself, but affords a clue to the solution of deep biological problems. Space, however, is limited, and I may express a great deal, in few words, by saying that the relationship borne by the urine to health is very similar to the old rule of three: As environment, in its broadest sense, is to the renal output, so is the latter to the health. If there be a difference, the cause is pathological.

CONTINUOUS COUNTER-IRRITATION AS A THERAPEUTIC MEASURE IN RHEUMATOID ARTHRITIS, ETC.

By W. J. MIDELTON, M.R.C.S., L.R.C.P.

Bournemouth.

FOR over eighteen years I have given this subject much attention. I was first induced to do so by Dr. P. W. Latham, who was then senior physician at Addenbrooke's Hospital, Cambridge. He treated three cases in that hospital, applying blisters in the neighbourhood of the cervical and lumbar enlargements of the spinal cord, and subsequently keeping the raw surfaces open by means of savin ointment. He read a paper on the subject at a meeting of the Cambridge Medical Society and subsequently published one in the *Lancet*. Later, he published a monograph entitled *Pathology and Treatment of Rheumatoid Arthritis*; Deighton, Bell & Co.

In 1831, Dr. J. K. Mitchell published a paper in the *American Journal of the Medical Sciences*, Vol. VIII., p. 55, describing his treatment of "rheumatic" conditions by means of cupping and blistering in the neighbourhood of the spinal cord. He appears to have secured remarkably beneficial results, and, in Dr. Latham's cases too, great benefit followed the treatment, particularly as regards relief of pain, diminution of swelling and increased mobility in the joints, greater power in the muscles, and improvement in the general health. From Dr. Mitchell's paper I quote as follows:

"In the autumn of 1827 a patient affected with caries of the spine was suddenly attacked with all the usual symptoms of acute rheumatism of the lower extremities. One ankle and the knee of the opposite leg tumefied, red, hot, and painful, afforded as fair a specimen of that disease in its acute state as is usually met with. The usual treatment by leeches, purgatives, and cooling diaphoretics, with evaporating lotions, had the effect of transferring the symptoms to the other ankle and knee, and finally to the hip. Disappointed in the treatment, I began to suspect that the cause of the irritation might lie in the affected spine. The difficulty of cure, the transfer of irritation from one part of the lower extremities to another without any sensible diminution of disease, and the fact of the existence of

lead one to test for the insoluble biurate. It should be kept in mind that gelatinous forms of the biurate are sometimes found. These are more soluble than the crystalline. As they dialyse, they are probably hydrated salts. Urates are deposited from acid urine only; but ammoniacal decomposition is quite compatible with a downfall of urates, because of the fact already stated—the seizing of the ammonia by free uric acid.

Albumen.—This may be in the form of hemi-albumose. It is not coagulable by heat.

Sugar.—Moore's test is quite worthless unless the urine is pale, and has been proved free of albumen. If there is albumen, it must be separated by filtration, after coagulation by heat. The presence of albumen would vitiate the test. It is also necessary to remove albumen before using any test into which copper enters, for albumen will prevent the precipitation of the oxide.

Another fact worth keeping in mind is, that glyconuric acid ($C_6 H_{10} O_7$) is sometimes present in urine that is not diabetic. This will precipitate the copper oxide, and may be wrongly set down as sugar. To distinguish between the acid and sugar, add to some of the urine a little yeast, and invert the test tube in urine. Glyconuric acid does not ferment, so no displacement of urine will occur by evolved gas. Perhaps it may also be forgiven me if I remind the medical man, that recent chloroform inhalation will reduce the copper oxide, and that salicylic acid, taken medicinally, acts similarly. Chloroform is sometimes employed as a preservative of urine. Drugs should never be used for this purpose. The only legitimate antiseptic for any material to be placed under analysis is *cold*. Thymol may persuade the observer that he is dealing with bile.

I could write a great deal more on a subject that is not only of interest, and of practical importance in itself, but affords a clue to the solution of deep biological problems. Space, however, is limited, and I may express a great deal, in few words, by saying that the relationship borne by the urine to health is very similar to the old rule of three: As environment, in its broadest sense, is to the renal output, so is the latter to the health. If there be a difference, the cause is pathological.

CONTINUOUS COUNTER-IRRITATION AS A THERAPEUTIC MEASURE IN RHEUMATOID ARTHRITIS, ETC.

By W. J. MIDELTON, M.R.C.S., L.R.C.P.

Bournemouth.

FOR over eighteen years I have given this subject much attention. I was first induced to do so by Dr. P. W. Latham, who was then senior physician at Addenbrooke's Hospital, Cambridge. He treated three cases in that hospital, applying blisters in the neighbourhood of the cervical and lumbar enlargements of the spinal cord, and subsequently keeping the raw surfaces open by means of savin ointment. He read a paper on the subject at a meeting of the Cambridge Medical Society and subsequently published one in the *Lancet*. Later, he published a monograph entitled *Pathology and Treatment of Rheumatoid Arthritis*; Deighton, Bell & Co.

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caries in the lumbar vertebræ, which lie near the origin of the nerves of the lower extremities, rendered probable that in the spinal marrow lay the cause of this apparently indomitable and migratory inflammation.

Under this impression, I caused leeches to be applied to the lumbar curve, and followed them by a blister placed on the same spot. Relief promptly followed these remedies, and the pain, ceasing to be felt in the limbs, was perceived only in the immediate vicinity of the spinal curve. After the blistered surface recovered its cuticle, a few leeches placed over the diseased spine removed the pain, and left the patient in the usual state of indifferent health attendant on such forms of spinal disease."

Dr. Mitchell subsequently treated a number of other cases on similar lines and with very beneficial results.

From Dr. P. W. Latham's paper I quote as follows:—

"Upon the foregoing data, it is not unreasonable to assume that the joint troubles in rheumatoid arthritis are due to spinal congestion or chronic myelitis, chiefly affecting the ganglion cells of the anterior horns, but extending also, when the disease is associated with glossy skin, to the ganglion cells in the posterior horns. If this is the case, the natural inference would be that, in the earlier stages of the malady at all events, the treatment should be directed to the abatement of this spinal congestion, and that probably this can be most effectively done by cupping or blistering the spine. On these grounds, therefore, this plan of treatment was adopted in the following cases."

It is clear that the minds of both these physicians were directed to the condition of the spinal cord in these cases, and that their clinical results, based upon their pathological reasonings, were excellent. I am, of course, personally aware that the "septic" theory of arthritis is now widely accepted, and I cordially agree that all sources of sepsis should be eliminated as far as possible, but it stands to reason that, when germs and toxins are circulating in the blood, no tissue can escape. The researches of Orr and Rams demonstrate clearly how germs and toxins may reach the spinal cord along the sheaths of nerves from septic foci. There is, therefore, no reason why the neural and septic theories should not go hand in hand.

I am quite convinced that a patient's troubles are by no means over when septic foci have been dealt with such as by complete removal of septic teeth. Germs may and do wander from one place to another, and small foci may exist literally in thousands all over the body in mucous membranes, fibrous tissue, etc. How are such minute foci to be

dealt with ?

The most fashionable method at the present time is by means of vaccines. Several years ago, I crystallized my opinion of these as follows : " Brilliant at times, uncertain for the most part, not without danger." I have not yet altered my opinion. I am under the impression, that it is particularly difficult to influence organic changes in the cord by means of vaccines, even when the changes are merely in the congestive or slight inflammatory stage.

I am convinced that Drs. Mitchell and Latham have demonstrated that it is possible to influence such changes beneficially by means of *continuous* counter-irritation, and my own results based on this belief are of the most encouraging character. Not only are changes in the spinal cord beneficially influenced, but the whole system improves when continuous counter-irritation is properly carried out for a sufficient period.

Amongst other improvements, I have noted the following in a sufficiently large number of cases to be beyond any possible question of their being mere coincidence :—

Pain and swelling have gone from joints, and movement has greatly increased.

Wasted and contracted muscles have thickened, elongated, and become more powerful.

Pads and fringes in the interior of joints have so diminished as no longer to cause pain or limitation of movement.

Fibrous and semi-fibrous thickenings of all kinds, such as adhesions, nodules and lipomata have disappeared ; in some cases, the nodules have been as hard to the touch as wood.

Deformities of arms, legs, toes and fingers have greatly lessened. For instance, in several cases of so-called pes cavus, in which the toes have become rigid and immovable, even when the condition has existed for years, movement has been restored, and pain and weakness in the leg and foot have, for all practical purposes, gone. Thickening of the skin and subcutaneous tissue, in some instances amounting to scleroderma, have been overcome and the skin made supple.

Legs that have looked like bladders of lard have assumed a normal shape and colour with the veins clearly seen.

Eruptions of many kinds on the skin, as well as discolorations, have cleared up. In one instance, a patient had

psoriasis from head to foot, and the skin all over the body was harsh and sallow. After a course of continuous counter-irritation, the psoriasis completely disappeared, and the skin became white and supple. Thyroid extract had been previously administered without much benefit, even when pushed to large doses.

"Wooden" facial features have become normal.

Sleep, appetite, digestion, and action of the bowels have greatly improved, and so are sight, hearing, taste, and smell. In one instance, a patient of 55 years of age was able to discard her spectacles, and to sew and read without them. In another, a patient who had suffered from polyarthritis and all that goes with it for over 20 years, and who had become bedridden and helpless, resumed lace work and embroidery after having given it up [for years through loss of power in the fingers and arms.

The mental capacity, too, greatly increases, and morbid thoughts of all kinds either diminish or go completely.

Skilfully and carefully carried out, the treatment is without serious risk, and sepsis plays no part in it. I seldom find leeches or cupping of any advantage.

The three methods I employ are:—

(1) The blister, followed by savin ointment.

(2) Multiple *superficial* acupuncture (thousands of punctures are made at each sitting), followed by irritants. I paint over the punctured area a mixture of croton oil, cantharides, and almond oil. The mixture is carefully proportioned in order to produce an eruption only and no blisters.

(3) The galvano-cautery. This is chiefly applied to the back near the spine. Small dots or dashes are made, the number being arbitrary and given according to the needs of each patient.

It has been argued by some that these methods are too drastic, that the cure is worse than the disease, and other nonsense unworthy of thoughtful, scientific men. Properly carried out, these measures entail very little suffering—certainly nothing like that endured by patients after most surgical operations. The agony I personally went through for two whole nights after an operation for appendicitis will remain as a terrible memory as long as I live, especially as

nothing was done for my relief beyond a turpentine enema.

When peeling off the blister, and during the first two or three applications of savin ointment, I give sufficient chloroform to deaden the smarting, and have never had any cause to regret it. I have no hesitation in giving opium in some form, such as omnopon or a mixture of tincture of opium and hyoscyamus.

No patient is too feeble for one or other of the methods. In very feeble cases, I apply the multiple acupuncture for a time, and later on the blister and savin, if necessary.

It is often asked, how do these remedies act? I answer by calling into action the mechanism by which germs and toxins are carried from deep parts by the blood to the skin and subcutaneous tissue, to be extruded through raw surfaces or precipitated into pustules in part, a further part being fixed in the skin and subcutaneous tissue and gradually burnt up.

Professor Gougerot, of Paris, has recently made important investigations on typhoid patients with regard to the eruption. His conclusions support the statements I have made above. An article by him appeared in the *Medical Press and Circular*, June 7, 1911, from which I quote as follows:—

“As far back as 1781, Borsieri suggested that, in these cases, the skin acted as an emunctory, and I am favourably inclined to the view that the integument plays a defensive part, endeavouring to fix and excrete microbial toxins and the products of auto-intoxication. I think, too, that in all probability the skin not only fixes the toxins but burns them up.”

“Each pink spot is due to a small microbial embolus of living or dead micro-organisms conveyed thither by the blood.”

Believing, as I do, that such diseases as hyper- and hypothyroidism are the outcome of poisoning by microbial toxins, as are asthma, diabetes, etc., I employ continuous counter-irritation as a remedy. It does not militate against the action of drugs or any other useful agent, but rather increases their efficacy.

In an analysis of 50 cases of arthritis deformans treated by means of blisters to the spine followed by savin ointment, the results were—

(1) Practically cured, 12.

- (2) Much improved, 19.
- (3) Distinctly improved, 13.
- (4) No improvement, 6.

All these cases were old standing and difficult, for the most part abandoned by other medical men as incurable.

Fifty cases of miscellaneous disease treated by means of acupuncture and irritants resulted as follows:—

- (1) Cured, 13.
- (2) Greatly improved, 25.
- (3) Distinctly improved, 8.
- (4) No improvement, 4.

All these cases, also, were difficult, and were labelled, paralysis of various kinds, arthritis (chronic), chronic neuritis, asthma, diabetes, etc.

PREVIOUS PAPERS.

THE PRACTITIONER, 1912:—

"Administration of Thyroid Extract in Rheumatoid Arthritis."

British Medical Journal, 1913:—

"The Comparative Value of Radium and Continuous Counter-irritation in the Treatment of Rheumatoid Arthritis."

Lancet, 1907:—

"Pathology and Treatment of Rheumatoid Arthritis."

Journal of Balneology, 1909:—

"Treatment of Rheumatic Diseases."

Proceedings of the Clinical Section, Roy. Soc. Med., 1914:—

"Notes on Cases of Dermatitis Herpetiformis, and Neuritis."

Medical Press and Circular, May 8, 1912:—

"Some Notes on Continuous Counter-irritation."

October 15, 1913:—

"Some Notes on Arthritis Deformans, with an Analysis of Fifty Cases treated by means of Continuous Counter-irritation."

Medical Times, October and December, 1914:—

"Continuous Counter-irritation in the Treatment of Nervous and other Diseases."



VALVULAR DISEASE OF THE HEART IN ARMY RECRUITS AND SOLDIERS PROPOSED FOR INVALIDING.

BY CAPTAIN S. WYARD, R.A.M.C., M.D., M.R.C.P.

DURING the past twelve months, it has fallen to my lot to form one of a Standing Medical Board. In this way, I have examined many hundreds of cases of all kinds, but a large proportion have been referred to the Board on account of a diagnosis of valvular disease of the heart having previously been made. In more than 50 per cent. of these cases, the Board was unable to confirm the diagnosis, and the man was retained in the army. If such a number of already enlisted men could be proposed for discharge on these grounds, how many intending recruits must have been rejected on the same grounds, one opinion only being then necessary, and their services, in consequence, lost to the country? During the course of these observations, therefore, it has been impressed more and more forcibly on my mind that, at the present time there must be a very considerable number of men in civil life, who have readily and willingly offered themselves for service, only to be turned away because of a disability that does not exist.

What is the reason? There are two. In the first place, recruiting has to a large extent proceeded spasmodically; after a period of comparative quiet, there has been one of excessive rush, when the medical examination has been carried out with the maximum of speed and consequently, it appears, the minimum of care. To examine properly two hundred recruits in one day is a physical impossibility, and yet it has been attempted, not once nor twice, but many times. Under such circumstances, careful and reliable investigation of any suspicious signs is obviously out of the question.

The second reason is of a different nature and of much greater importance. It proceeds from an incorrect estimate of the relative importance of the various methods of cardiac examination. For the military purposes under consideration,

viz., enlistment into and discharge from the army, it may be taken as a rule that no importance can be attached to, nor reliance placed upon, the history as related by the man nor his description of any symptoms; in the former case, he suppresses, denies, or makes light of anything which he believes may cause his rejection, while in the latter he adds to, and makes the most of all such points. The five senses, then, of the observer supply the only data upon which a sound judgement can be based, and it is essential that the facts obtained in each of these five ways should be carefully collated, and the proper weight assigned to each in the final summing-up. Herein is the crux of the matter. In making this statement, I am not unmindful of the valuable and interesting discoveries and observations made by Sir J. Mackenzie and Dr. T. Lewis, but the electro-cardiograph, and even the comparatively humble sphygmograph, is beyond the reach of the average R.A.M.C. officer.

At the present time, there seems a very general tendency to attach far too much importance to auscultation in the diagnosis of cardiac affections. That it is an extremely valuable method no one will deny, but it is apparently often considered of supreme value, whereas, in fact, for the mere diagnosis of valvular disease apart from its localization in a particular valve or valves, it is of secondary consequence. If this be thoroughly appreciated, many mistakes will be avoided.

The examination of the heart should always be conducted in a routine manner, never neglecting any step in it, however unnecessary it may appear in any particular case. More especially is this so where some doubt may exist, such, for example, as when compensation is perfect or nearly so, and no symptoms referable to the heart have yet become manifest. Where compensation has broken down, bringing about the typical effects upon the peripheral circulation, the lungs, kidneys, etc., there can be no difficulty in determining that the heart is diseased, even though the exact lesion be obscure.

The appearance of the individual yields little or no evidence of value. Pallor of the skin and mucous membranes commonly accompanies aortic regurgitation; the face may be congested and cyanotic with mitral stenosis, and markedly

cyanotic in congenital disease of the heart, but since these signs are not constantly present, and they may further be produced by conditions other than these, they are at best but confirmatory, and cannot be said even to indicate a cardiac lesion. Similarly clubbing of the fingers—pulmonary osteo-arthritis—though often seen in association with congenital morbus cordis, is also a frequent concomitant of pulmonary disease. Clubbing of the fingers should not be hastily diagnosed merely on the presence of a well-rounded finger-nail. The condition consists in a definite alteration of the terminal phalanx in that, besides a curved and somewhat claw-like nail, the skin of the dorsum of the finger between the nail-groove and the distal interphalangeal joint, is curved, and its line tends to run continuously into the curve of the nail itself; the phalanx is broader than usual at its distal end, and may indeed be actually broader than at the proximal end.

PULSE.

As a rule, when compensation is complete, the pulse-rate is little if at all raised but, the reserve force of the heart being diminished, it will often be found that the increased pulse-rate caused by extra exertion will persist over a longer period than with a healthy organ. Sometimes, in aortic stenosis, the pulse is slow, while, in mitral disease, after the onset of auricular fibrillation, it is generally rapid, though occasionally slow. To determine the tension of the pulse, the sphygmomanometer is required. A rough estimate may be made by the fingers, but it is very rough and cannot be relied upon. Even when determined it is of comparatively little value, since many conditions other than disease of the valves cause a rise or fall in the blood-pressure. The volume is generally diminished. The characters of the pulse in aortic incompetence are peculiar and best noted by grasping the wrist of the patient and raising the part above his head. The impulse is sudden and sharp, followed by as sudden a collapse, and frequently the pulse takes longer to travel from the heart to the peripheral vessels, so that the period between the heart-beat and the consequent pulse-beat is increased. In addition, pulsation is often visible in the cutaneous capillaries, *e.g.*, the nails may be seen to flush with each systole and become paler

with each diastole ; or, by gently pressing the tip of the nail, a white anæmic area is produced, and the line between it and the pink portion may alternately progress and retrogress ; or again, by gently stroking the skin of the forehead several times with the finger-nail, a hyperæmic line develops, the margins of which pulsate.

Of the greatest importance is any change in the rhythm, and, where irregularity is found, a careful investigation of the cause is called for. In many cases, however, it is of no consequence, and does not indicate a valvular defect, so that no conclusion can be based upon this fact alone. In other cases, it will indicate a very serious condition, but whether or not it does so in any particular case must be determined by the type of irregularity and comparison of the pulse with the action of the heart. Pulse irregularity is due to cardiac irregularity which is discussed below.

Valvular disease of the heart is sometimes associated with an adherent pericardium, when the *pulsus paradoxus* may be noted, *i.e.*, with inspiration, the pulse-wave becomes more feeble, to increase again in force with the following expiration. This is the reverse of the normal sequence.

HEART.

Turning now to the heart itself, first of all proceed by *inspection*. The position of the impulse is noted. If the chest be well covered or thick walled, and when the lungs are emphysematous, it may be invisible. If seen, what are its characters ? It is generally localized, but in a thin or emaciated person, as well as if the heart be dilated or hypertrophied or both, it may be diffuse. In pulmonary tuberculosis, when contraction of the lung has uncovered the heart, a wave-like impulse may be observed passing from above downwards and outwards. Epigastric pulsation is often indicative of dilatation of the right ventricle. In young subjects the precordium may be bulged forwards by the greatly enlarged heart and in middle-aged or elderly men, a more or less localized, pulsatile swelling may reveal the existence of an aortic aneurysm. Increased rapidity of heart-beat, heaving and thudding impulse, and epigastric pulsation—all or any of these may be observed in a nervous and excitable person

possessing a perfectly normal and healthy heart.

Palpation.—With the tips of the fingers the impulse can be localized. It is normally in the fifth intercostal space, $3\frac{1}{2}$ inches from the middle line. All reference to the nipple line is best avoided, even in the male. It is probably preferable thus to localize, not the position of maximum intensity of the impulse, but the lowest and most external point at which it can be felt. Displacement downwards and outwards indicates aortic regurgitation, but more or less horizontally to the left, affection of the mitral valve. In fat and thick-walled chests or with marked pulmonary emphysema, the impulse may be almost or completely impalpable. If it cannot be felt in the usual position, careful search should be made elsewhere, otherwise displacement or transposition of the heart may be overlooked. Alteration in the position of the impulse, while often due to change in the size of the heart, may also be effected by pneumo-thorax or pleural effusion on the side opposite to the displacement or pulmonary tuberculosis on the same side. By placing the palm of the hand flat upon the chest over the region of the apex beat its character may be recognized. If heaving, hypertrophy of cardiac muscle is suggested; if slapping, dilatation, but allowance must be made for the condition of the chest wall, viz., whether well covered or not. Irregularity of the heart-beat will be discussed in dealing with the method of auscultation. It should be remembered that palpitation, though often a sign of heart disease, is more generally associated with pulmonary affections. It is also a marked feature of exophthalmic goitre, and very often an effect of gastric indigestion with flatulence. Any person of a nervous disposition may complain of this symptom. A thrill, if felt, is of great diagnostic value, being present in the greater number of cases of mitral stenosis, and a few cases of mitral regurgitation. In the former, it is presystolic in time, coarse and rough in quality, and the area over which it is present is very limited in extent. In the latter case, it is a softer thrill, systolic in time, but also limited to a small area.

If the pericardium be adherent, there may be retraction over the apex during systole; this is also occasionally found with aortic regurgitation.

In thin or emaciated individuals, however, and very

with each diastole ; or, by gently pressing the tip of the nail, a white anæmic area is produced, and the line between it and the pink portion may alternately progress and retrogress ; or again, by gently stroking the skin of the forehead several times with the finger-nail, a hyperæmic line develops, the margins of which pulsate.

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In thin or emaciated individuals, however, and very

occasionally in those who are well nourished, a lengthening of the impulse is noted, closely resembling a thrill, but less definite and of shorter duration, even where no other evidence whatever of a cardiac lesion is forthcoming. At the base, a thrill may be felt over the aortic area in cases of aortic stenosis. It is systolic in time. Where an aneurysm exists, pulsation and a diastolic shock may be felt in that part of the chest-wall deep to which it lies, but the latter is present too in many cases of uncomplicated aortic regurgitation. In cases of mitral stenosis, pulsation may be felt over the inner ends of the third and fourth left intercostal spaces, due not to the dilated and hypertrophied left auricle, which never gets far enough forward to reach the chest-wall, but to the greatly enlarged right ventricle.

Percussion.—Since part of the anterior surface of the heart is overlapped by the edges of the lungs, while the remainder comes into direct contact with the anterior chest-wall, an area of complete dullness to percussion is obtained, which fades more or less gradually into the pulmonary resonance. The smaller area is the area of superficial cardiac dullness, the larger that of deep cardiac dullness. Whether the former can be accurately defined by percussion is doubtful. If attempted, percussion should be as light as possible. Moreover, granted that accuracy be attained, the value of this determination is but slight since the size of the area depends to so great an extent upon the condition of the lungs. When there is considerable enlargement of the heart, this organ may press aside the margins of the lungs and so increase the area of superficial cardiac dullness, but, as a rule, no argument can be made from the extent of this dullness as to the size of the heart. Of very much greater importance is the delimitation of the area of deep dullness, for which a somewhat firmer percussion is necessary when almost absolute accuracy is attainable. Not only should any lateral increase be noted but also its vertical extent. Enlargement from above downwards is suggestive of aortic regurgitation; laterally to the right, mitral stenosis; laterally to the left, mitral regurgitation.

The plexophore finger must always be placed parallel with the ribs and entirely over a rib or entirely over an intercostal space, not partly on one and partly on another of these.

The strokes of the pleximeter finger should be in a quick succession of single blows moving the plexophore after each stroke. In this way a more delicate comparison between the notes at adjacent spots can be made than where the strokes are slower, and consequently the one note has to be carried for an appreciable time in the memory before being compared with the next. The resistance of the chest-wall to the finger also varies with the underlying tissues and so affords information, being greater over the solid heart than over the spongy lungs.

Lastly, *Auscultation*.—Examination by the preceding methods is sufficient in practically every case to establish or exclude the diagnosis of valvular disease of the heart. Auscultation yields confirmatory evidence, and helps to localize the lesion. The ease with which the sounds are heard varies with the nutrition of the individual, his physical development and the condition of his lungs. Distant heart sounds must, therefore, be carefully distinguished from weak heart sounds, and they should be actually heard not imagined; it is inadvisable, for instance, to auscultate only to the left of the sternum when the heart is situated in the right axillary region, as I have seen done.

Apparently, the first and chief object of auscultation is to determine the presence or otherwise of a murmur, but it would be far better to settle, before all else, whether or not the first and second sounds are normal. As far as I have been able to observe, difficulty most often arises in connection with the sounds heard at the apex. At the other areas, the line of demarcation between normal and abnormal sounds is sharp and well defined, but at the apex it becomes indistinct or ceases to be a line, and the normal first sound graduates almost insensibly, by a series of variations, into the abnormal. The first sound is dull and prolonged compared with the second, but the ratio of the duration of the one to the other is not fixed. Often the first sound appears somewhat muffled, or it may possess a slightly roughened character; sometimes, it is prolonged rather more than usual. These signs cannot, in themselves, be accepted as evidence of a valve lesion, but here, as at any area, the sounds may be modified or obscured by murmurs, and in a few cases some difficulty may thus be presented in distinguishing between a long sound and one

immediately preceded or followed by a short, faint murmur.

At the apex, the first sound has, in cases of mitral stenosis, a peculiar short, sharp character which, once heard, can scarcely be forgotten. In aortic regurgitation, it is clearer than usual, while it may be diminished or even absent when the mitral valve is incompetent. Except when obscured by murmurs the second sound is always audible, and in mitral incompetence it is often to some extent accentuated.

At the aortic area, the first sound is subject to little, if any, modification, whereas the second may be altered in some of several ways. In cases of incompetence, the second sound may be diminished in intensity, normal or accentuated, and, if the arch of the aorta be dilated, may also possess a metallic, ringing character. Stenosis of this valve causes diminution or loss of the second sound.

The pulmonary second is accentuated with mitral regurgitation and stenosis; with the latter, it is frequently reduplicated. This sign is of very great value in the diagnosis of mitral disease, but it must be remembered that contraction of the left lung in pulmonary tuberculosis by uncovering the left side of the heart may cause the pulmonary sounds to appear louder than in general. When pulmonary stenosis exists, the second sound is weak or absent.

CARDIAC IRREGULARITY.

This is a very large subject, and for a detailed consideration of it the reader is referred to its special literature, but a few remarks may properly be inserted here. Irregularities of the heart's action may be divided into five types,¹ viz. :—

(1) Sinus irregularity, most frequently seen in young people. The interval between the first and second sounds is regular, but that between the second and first sounds is variable. Increase in the depth and rate of respiration causes the irregularity to be less marked. It produces no symptoms and is of no importance.

(2) Extra-systoles. Some of the heart contractions take place prematurely, so that the interval between such a premature beat and the preceding beat is diminished, but the pause following it until the next beat is lengthened. The

¹ See Lewis, *The Mechanism of the Heart Beat*, from which the following classification is adopted.

sum of the short pause and the long pause equals the sum of two normal pauses. In some cases, the extra-systole causes no pulse wave in the arteries, so that pulse irregularity may not correspond with cardiac irregularity; in other cases, the pulse wave due to the extra-systole may be weaker than the other waves. The condition is not evidence of disease of the valves, though it often accompanies such disease. Extra-systoles are sometimes found apart from any other cardiac lesion. In the latter case, the irregular action is of no importance, and does not cause disability. It is also frequent in middle and old age.

(3) Depressed conductivity, when some or all of the sinus contractions fail to produce ventricular contraction. A condition of heart-block prevails. The pulse is always abnormally slow.

(4) Pulsus alternans. The strength of the heart-beat varies, every second contraction being weaker than the preceding. It is an alteration in the force of the beat, not in its rhythm. It is of the gravest prognostic import.

(5) Auricular fibrillation—*delirium cordis*. This is the most complete irregularity—no two beats are equal in force, nor equally spaced in time between the preceding and following beats. It is a concomitant of broken or failing compensation, though sometimes compensation may become, and remain for a considerable time, comparatively good after the establishment of this change. Occasionally auricular fibrillation will pass away under appropriate therapeutic methods, but generally, having once made its appearance, it persists to the end. The pulse is generally rapid, but may be slow. This condition is peculiarly liable to occur in the subjects of mitral disease, both stenosis and incompetence.

MURMURS.

Passing now to the last point, are any adventitious sounds to be heard? If so, what are their characters? Cardiac murmurs may be divided into several classes, viz. :—

A. *Subjective*, i.e., have no real existence but are conceived entirely in the observer's mind.

B. *Objective*—

a. Artificially produced by the patient.

- b. Produced in the stethoscope.
- c. Produced between the stethoscope and the chest-wall.
- d. Pleuro-pericardial.
- e. Hæmic.
- f. Organic.

A. *Subjective*.—In most cases, if one listens long enough and is determined to find a murmur, it can be done. In so many cases, too, when a murmur has been found subsequent examination has failed to reveal it, and all the physical signs have been so typical of a perfectly normal heart that I am at a loss for another explanation than that the first observer imagined the murmur which he recorded.

B. *Objective*.—a. This is, of course, rarely attempted, and is detected with the utmost ease both by the character of the noise and its lack of correlation with the heart movements. I have only come across one instance of it.

b. This also is easily detected, and may be due to an infinity of causes, especially when the tubing of the instrument is thin and worn; when the breath of the person impinges on the tube; when it is touched by a portion of the clothing, if, as should never be the case, the patient be not stripped, etc.

c. When the chest is poorly covered and the ribs stand out, or the chest-piece of the stethoscope is carelessly applied, the whole extent of its circumference may not be in touch with the skin surface. The presence of cutaneous hairs will scarcely cause the simulation of a murmur.

d. Pleuro-pericardial murmurs are very frequently mistaken for organic. They may be differentiated by the absence of other evidence of cardiac disease; that they are systolic in time; their locality—the position of maximum intensity is rarely the same as that of any murmur of valvular disease; they show no particular direction of conduction; their intensity rises and falls with the phases of respiration, being, as a rule, louder with inspiration than with expiration, though occasionally the reverse may hold; they may almost or completely disappear with cessation of the respiratory movements; they are more evident in the erect than in the recumbent posture.

e. The so-called hæmic murmurs are heard in cases of exophthalmic goitre and any of the anæmias. They vary much in intensity in different cases and are frequently very loud. They are most commonly heard over the apex, but sometimes at the base; and systolic in time or, very rarely, diastolic. The mechanism of their production is not yet known, and it may be valvular; cardiac dilatation is often co-existent, so that to distinguish between such a murmur and one due to endocarditis is only possible by a thorough consideration of all the facts of the case.

f. The organic murmurs alone of all these indicate a pathological condition of the heart, so that it is of the utmost importance to be able to recognize them with certainty. This may be done by considering the following points:—

(1) They are invariably accompanied by other signs of cardiac disease discoverable by inspection, palpation, or percussion.

(2) Situation, *i.e.*, the position of maximum intensity; it is fairly constant and characteristic. Mitral murmurs are loudest in the region of the impulse and, in the case of stenosis, localized to a very small area; aortic murmurs over the second right costal cartilage; pulmonary over the third left costal cartilage; tricuspid on the right edge of the sternum at the junction of the fourth and fifth costal cartilages. In the case of congenital affections, the locality varies, but is generally over the base of the heart and of wide extent, frequently being heard all over the chest.

(3) Conduction, *i.e.*, the line along which the sound is carried. For example, the murmur of mitral regurgitation passes out into the left axilla and may reach the posterior surface of the body, when it will be heard over the inferior angle of the scapula. It is carried only a very short distance inwards. The aortic regurgitant murmur is generally heard down the left margin of the sternum and sometimes the right.

(4) The time—that portion of the cardiac cycle occupied by the murmur, whether systole or diastole, and if the latter, whether early, middle, or late in the period. A late diastolic naturally becomes a presystolic murmur.

A systolic murmur at any area is, of itself, absolutely without significance, and, unless accompanied by confirmatory signs, may safely be neglected. More especially is

- b.* Produced in the stethoscope.
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SUBLINGUAL MEDICATION.

By W. PAULSON, L.R.C.P.

RIGHTLY or wrongly, I am of opinion that this method of administering medicine has not received from practitioners the attention it deserves. Since I first devised it, now some thirty years ago, I have used it in my own practice constantly, and invariably with success. May I ask anyone reading this, to be good enough to refresh his memory, by looking in the nearest mirror, at the sublingual space? Note the thin membrane, the considerable area, and the large veins, denoting a free flow and return of blood. The space is always smooth, never furred like the tongue, never shielded by mucus, as the stomach always is when in active rebellion, or, may be, masked by half-digested food.

For the absorption of concentrated remedies (unchanged and uncontaminated) directly into the circulation, I regard the sublingual space as the most reliable surface in the whole body. The only preparation necessary is rinsing with water, if the mouth is dry. A morphia and atropia disc, powdered with the point of a penknife, on paper creased in the centre, and dropped just behind the teeth, the tongue being restored to its normal position, will be absorbed in a few seconds. The full effects of the dose may be absolutely depended upon, almost immediately.

Colliery and quarry practice often provide surgeons with casualties, not unlike those in military work; in both, a morphia and atropia tablet relieves pain and shock as nothing else will. I know that they were extensively used during the South African War, and have found their way into ordinary practice, entirely on their own merits. Their adoption by the Services would, I am certain, be of inestimable benefit. An apomorphia disc, administered in the way indicated, will induce vomiting at once. Compared with hypodermic injection, the sublingual method is quicker, easier, safer, cleaner, and far more reliable.

Who has not, in an emergency, been annoyed by the

this so at the aortic cartilage. Aortic stenosis is of extreme rarity, and should be diagnosed with the greatest caution. A lengthening of the mitral first sound is sometimes mistaken for a presystolic or systolic murmur. A diastolic bruit, on the contrary, almost always means an organic lesion.

(5) The character of the murmur varies enormously: if diastolic, it may be soft and blowing, deep and rumbling, or distinctly musical; while systolic bruits are nearly always blowing.

Organic murmurs are not invariably present, even when an actual lesion exists, *e.g.*, it may be audible when the individual lies down, but disappear when he resumes the sitting or erect posture; or the heart may be so thoroughly compensated that no adventitious sound is heard under ordinary circumstances, but, after some unusual exertion, a well-marked murmur may develop. As a rule, it may be taken that a loud murmur indicates a well-working heart, whereas a faint one points to the fact that the myocardium is reaching the limit of its power.

It will be seen, then, that auscultation is not alone sufficient to establish a diagnosis of valvular disease of the heart, and that, if too much relied on, will sooner or later lead to grave errors. It is not enough merely to listen, but the senses of sight and touch must also be called upon for aid. In fine, it may be said that a heart normal in size, regular in its rhythm, and giving rise to no symptoms may be assumed to be perfectly healthy, whether or not a murmur or murmurs be audible in its neighbourhood.

Above, I have attempted to indicate those points which require consideration in the case of men, presenting themselves for enlistment in the army, in whom the heart is healthy or compensation is perfect, so that no symptoms have yet supervened. Moreover, in such circumstances, the history is either unobtainable or cannot be relied upon. The same applies to many cases in which a man is proposed for discharge on medical grounds. I have throughout directed attention only to the distinguishing between a normal heart and one the subject of a valvular defect. Another matter, and outside the scope of these notes, is the determination of the particular valve, if any, at fault.

A CASE OF EGG-POISONING (ANAPHYLAXIS).

By R. S. C. EDLESTON, M.R.C.S., L.R.C.P.

Ashenfell, Baslow, Derbyshire.

IN the case of a girl under my observation, the first signs of egg-poisoning occurred at the age of about 12 months. The child had what was thought to be an acute attack of gastritis, with frequent vomiting, after a few teaspoonfuls of custard pudding. She was put on albumen water and rapidly collapsed. Thinking that the egg might be acting as a poison, no food was given for several hours, and she was then given chicken broth. Under this treatment she rapidly recovered.

Eggs in every form were avoided after this, and the next dose was accidentally administered by a friend, who gave her a sponge cake; she rapidly collapsed, with violent vomiting. Now and again, egg in some form or other has accidentally been taken, and the symptoms usually have been as follows:—

Directly food containing egg has been taken, she shudders as though the food tasted nasty; then she complains of feeling ill, and wants to lie down. The pupils rapidly enlarge to full dilatation, and, after a longer or shorter interval, vomiting follows.

In some attacks, chemosis of the conjunctivæ supervenes, and the œdema at times is so great that the corneæ appear as though at the bottom of a deep cup. Urticaria occurred in some of the attacks. On one occasion, she was standing near her mother, who was beating up an egg on a plate, and apparently a splash of egg flew into her eye. The eyelids rapidly swelled up so that the eye could not be opened, but no other symptoms of poisoning followed.

She is now nearly 11 years of age and is still as sensitive as ever to the poison. I shall be glad of any suggestions as to treatment. A friend recently called my attention to a report of cases in the *Boston M. & S. Journal* of November 5, 1914, by Oscar M. Schloss, in which immunization, in at any rate one case, was effected by minute doses of ovomucoid, administered in capsules in gradually increasing doses.

I am hoping, by the publication of this case, to receive further suggestions which may lead to a rapid cure.

cleaning of the spoon, dissolving the tabloid, freeing and fixing the needle, drawing in the solution, cleansing the skin, and then the injection, generally into fatty and feebly absorbent positions? As to the obviously necessary sterilization, in war time, when crowds of wounded await relief, it is not possible, while its neglect may, and, probably will, add a loathsome disease to those to whom we owe so much, and who surely deserve every possible care and protection. Few German soldiers, after three years of barrack life escape infection, and, unfortunately, a proportion of our own soldiers suffer likewise.

A case or two from my own practice will illustrate my claim to the efficiency of this means of medication.

CASE 1.—A neighbouring practitioner, early one morning took a dose of salts, and washed it down with what he thought was *aqua chloroformi*, but, in fact, was about two ounces of a strong solution of chloral. The dose was colossal. He was a big powerful man, but fell trying to reach the telephone. When I arrived a nearer surgeon had tried artificial respiration but said the case was 'hopeless'. He believed the patient was dead, for he had ceased to breathe, and no pulsation could be detected. By way of a last chance, I inserted a strychnia and two apomorphia discs under his tongue, and rolled him over on to his left side. I did not record the time, but well within a minute he made a valiant effort, and vomited, and finally recovered. A year or two afterwards he developed malignant disease of the stomach, and died, the result, probably, of the caustic action of the chloral.

CASE 2.—A woman, of intemperate habits, drank a quantity of Jeyes' fluid. I saw her almost at once, she was collapsed and insensible; a rinse of warm water and a couple of apomorphia discs, emptied the stomach promptly and effectually. The stomach gave her a good deal of trouble subsequently, as might be expected, but when I lost sight of her, she was fairly well again.

CASE 3.—An excited woman, with a crying child, came into my surgery, the child had drunk some eye lotion, labelled "poison," from a hospital bottle. I gave the usual emetic disc, and promised to bring the tube and examine the bottle. On arrival at the house, the mother said: "Oh, Doctor, I don't think you need use that, she was sick all the way home." The lotion was only boric lotion, so, like the fire brigade, when Artemus Ward's wife had twins, I refrained from squirting.

For the relief of severe pains, such as those of renal or biliary calculi, and on many other occasions, both in military and ordinary practice, the method described will be found of incalculable service.

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Practical Notes.

FURTHER DETAILS ABOUT THE SOLUTION OF HYPOCHLORITE OF MAGNESIUM.

Duret, the pharmacist at No. 3 Hospital, Tours, has made experiments with this substance, and as the result recommends the use of the following solution, which is isotonic with blood-serum. The formula is:—

Chloride of lime	-	-	28 grm. (℥vii.)
Magnesium sulphate	-	-	18.20 grm. (℥ivss.)
Water	-	-	1000 grm. (℥xxxv.)

The two salts are triturated in a mortar, and the water is then added by degrees to the powder so produced. The solution is then filtered through cotton wool. The clear solution thus obtained is of complex constitution, and contains:—(1) hypochlorite of magnesia; (2) magnesium chloride; (3) bi-carbonate of magnesia, held in solution by the magnesium salts; (4) soluble hydrate of magnesia; (5) soluble oxychlorides of magnesia.

The liquid is very stable, very much more so than Labarraque's fluid or Dakin's solution. In contact with wounds, it liberates its chlorine gradually, and will keep intact for a long time its antiseptic properties. In proportion to its decomposition, it gives rise to magnesium chloride and to hydrated magnesia, which will form soluble oxychlorides of magnesia, and, in the presence of the sodium chloride in the blood, will form as well soluble double oxychlorides of magnesia and soda. Moreover, its alkaline reaction and its isotonicity with blood-serum render the fluid favourable to the elements of the organism. It is in no way hurtful to the cells, for it is free from irritating substances like boric acid and the borates.

For use it should preferably be warmed to 35° C. (95° F.), and, to increase its rapidity of antiseptic action, it may be decomposed in the depths of the tissues by using hydrogen peroxide solution. 85 c.c. of the 12-volume solution will suffice to decompose all the hypochlorite contained in one litre of solution. The two liquids may be introduced at the same time into the depths of the tissues by two separate nozzles or by one nozzle joined up by a separate tube to each holder. The ebullition resulting in the depths of the wound will carry the antiseptic into every nook and cranny, thus exerting a powerful mechanical detergent action. The wound and its surroundings are then flooded with the hypochlorite solution alone.—(*Journ. de Méd. et de Chir. prat.*, 10 August, 1916.)

TREATMENT OF CONSTIPATION IN MILITARY PRACTICE.

Martinet points out that, owing to the meat diet, to the small quantity of green vegetables, to the relatively sedentary existence,

and to other conditions, constipation in the military area is much more common than it might have been supposed at first. Under the existing conditions, it is not possible at the front to make use of the hygienic methods, especially the gymnastic movements, which are so useful for promoting the abdominal functions; laxatives are a necessity. Martinet divides into four categories those which are most practical for the purpose.

1. Liquid paraffin, now easily obtained pure, should be given continually in a daily dose of from one to four teaspoonfuls every morning on rising, or one hour before the evening meal. An immediate result must not be expected, but, after a few days, a regular action is brought about.

2. Belladonna, which was recommended by Trousseau and Pidoux, more than fifty years ago, may be given in pills, each containing 1 c.g. of extract and as much of the powder, one, two, or four being taken. In some cases a spoonful of castor oil or of magnesia, in addition to the belladonna, taken at night will complete the effect. Once a regular habit has been obtained, both the oil and the pills may be reduced in dosage gradually.

3. Castor oil may be given alone, in combination as above mentioned, or its administration may be followed with a dose of liquid paraffin, taken daily or every second day.

4. Sulphate of soda is particularly useful in the numerous cases in which hepatic congestion is pronounced. For a laxative effect, a daily dose of from 4 to 6 grm. (one teaspoonful) in half-a-litre of water should be taken in two portions, one before breakfast and the other during the morning. If a free purge is required, larger doses are necessary; from 25 to 60 grm. in 200 or 250 c.c. of cold water should be taken.

In exceptional cases, the use of the following pills is recommended :

R	Extracti Hyoscyami	-	-	-	-	2 c.g.
	Extracti Rhei					
	Extracti Cascaræ Sagradæ					
	Euonymin.	-	-	-	ana	5 c.g.
	Saponis medicinalis	-	-	-	-	q.s.
	Misce. Fiat pilula.					

"Two or three a day to be taken at meals."

Martinet further recommends that every care should be taken, whenever possible, that the "necessities" provided are kept as clean and sweet as possible, so as not to have an inhibitory effect brought about by disgust.—(*Presse médicale*, No. 34.)

Reviews of Books.

Cleft Palate and Hare Lip. By SIR W. ARBUTHNOT LANE, Bart., M.S., F.R.C.S. Pp. 102. London: Adlard and Son. 10s.

THE new edition of Sir Arbuthnot Lane's book on cleft palate and hare lip has been enlarged by the addition of two important chapters: one by Mr. Cortlandt MacMahon, on speech training, and the other by Mr. Warwick James, dealing with dental treatment. These chapters will amply repay perusal.

But, in view of recent discussions on the subject, one turns to the book proper with special interest, and one is disappointed to find it so nearly unchanged. As in the second edition, about half of it is given to introductory remarks, not all of which are evidently related to the matter in hand. Hare lip might almost have been omitted from the title, for the subject is disposed of in a few lines.

After a preliminary statement that the author's method of operating for cleft palate is "incomparably superior to the usual methods of paring the edges of the cleft and bringing them together," one is not surprised to find that no further mention of these other methods is made. Nor is there any attempt to support this assumption of superiority by a record of results. A short statement of the mortality in a hundred cases operated on by the author appears on pages 35-37; the mortality is given as 8 per cent. for primary operations, but the patients seem not to have been followed after they left hospital; half of the cases required more than one operation.

The operative procedures recommended are little altered from the last edition, but some of the more elaborate figures and descriptions have been omitted. It is noteworthy that the posterior palatine vessels and nerves on the side from which the flap is reflected are no longer clamped and divided as they issue from the canal, but are preserved in the flap, and are figured on p. 46 supplying it.

Sight-Testing Made Easy. By W. WRIGHT HARDWICKE, M.D., M.R.C.P. Pp. viii + 80. Figs. 12. Third edition. London: J. and A. Churchill. 2s. 6d. net.

THIS little manual, originally compiled in the form of notes as aids to memory, has been thoroughly revised and partly re-written. It is divided into three parts: the first deals with lenses, refraction, heterophoria and strabismus; the second, with subjective sight-testing; and the third, with objective sight-testing (retinoscopy). The subject-matter is contained in numbered short paragraphs, which facilitate the cross-references with which they are in places provided. Statements may here and there be open to criticism, but in such a small and condensed handbook they must necessarily be dogmatic

and brief. If, as the author intends, the manual is merely used as a companion to larger and more comprehensive works, it will serve to assist beginners in dealing with refraction cases. That it has proved helpful is indicated by the attainment of a third edition.

Applied Immunology. The Practical Application of Sera and Bacterins prophylactically, diagnostically and therapeutically, with an Appendix on Serum Treatment of Hæmorrhage, Organo-Therapy and Chemotherapy. By B. A. THOMAS, A.M., M.D., and R. H. IVY, M.D., D.D.S. Five plates, 65 figures, 349 pp. London: Lippincott Company. 15s.

THIS work collects in one volume much of what is known of the practical uses for sera and vaccines in human diseases. It opens with a very lucid explanation of immunity and Ehrlich's side-chain theory, then deals with antitoxic and antibacterial sera. Some chapters are then devoted to agglutinins, precipitins, and lysins.

Complement fixation is fully and very clearly dealt with, and the most absolute novice ought to know all about it after perusing the book. One chapter is given to bacterial cutaneous reactions, one to tuberculin therapy, and one to phagocytosis.

The concluding chapters deal with vaccine therapy and the opsonic index.

The book is undoubtedly a useful addition to one's library. The print is large, and the subjects are dealt with in a very readable manner, without overburdening the reader with figures and formulæ.

The book is obviously intended for the practitioner more than the student, though the theories and methods are described in such a manner that the most uninitiated beginner ought to grasp them. One feels, in reading through the book, that much of the simple and perfectly elementary matter might have been left out with advantage, and more information been given on some subjects which are only very scantily dealt with. As in so many books of this nature, one finds that all subjects do not receive anything like equal treatment, the pet subjects of the authors receiving far more than their due share of space.

Some of the illustrations are rather absurd in their simplicity, as, for example, Figs. 7, 8, 9, 11 and 13, which might be left out without lessening the value of the book in any way.

Fixation of the complement takes up 66 pages out of 349; yet the treatment of hydrophobia is given less than two sides of a leaf.

It seems rather a pity to multiply terms, as in the use of the name "Micrococcus aureus" instead of the universally used "Staphylococcus pyogenes aureus."

The method of portraying the "Wassermann reaction" on a large chart is admirable, except that the chart is inaccurate in detail, the temperature 56° C. having been put in all six instances in mistake for 37° C. Needless to say, a temperature of 56° C. would render the test useless.

On page 181, line 16, the word "central" should read "control"

several cases in detail, for only by doing this will his method convince others.

On Modern Methods of Treating Fractures. By ERNEST W. HEY GROVES, M.S., M.D., B.Sc., F.R.C.S. Pp. 280. Bristol: John Wright and Sons, Ltd.

PROBABLY the work of Hey Groves on the treatment of fractures stands out with that of Sir Almroth Wright on the treatment of wounds as the greatest achievement in "medicine" brought about by the War. The portion of the book, dealing with experimental observations on the operative treatment of fractures, has appeared in a recent edition of the *British Journal of Surgery*.

In the words of the preface, the work is a "critical examination of the various methods of fracture treatment, and an indication of the conditions in which one or another ought to be employed."

Chapter ii. contains a short review on massage and mobilization. Chapters iii. and iv. deal with adhesive appliances and extension.

The deductions drawn from experimental observations are chiefly—

1. The most rapid and perfect method of fracture repair follows fixation, which does *not* directly interfere with the area of fracture.
2. The mere presence of an aseptic indifferent foreign body has no ill-effect on healing.
3. The grip of a screw on bone is merely "frictional," and will quickly give way if subjected to much tension.
4. Union by plates and short screws is inefficient, because the screws are quickly pulled out of the bone and sepsis follows (but is not the cause of) a mechanical fixation, which is imperfect.
5. Perfect mechanical union can be achieved by (1) long plates with bolts which *transfix* the bone; (2) intramedullary pegs of a certain kind.

Chapters vi. and vii. deal with operative treatment in detail.

Chapter viii. with open fractures, whilst chapter ix. is occupied with an account of ununited fractures.

It must be conceded at once the whole story is a most convincing one most admirably recounted and generously illustrated with beautiful drawings.

The failure to agree with the views of Sir Arbuthnot Lane is not in any way surprising to those of us with a large experience of bone surgery, whilst the views expressed of the treatment of such open fractures as are seen in this War are proved by one's experience to be absolutely sound.

It may be said also that the criticism of the apparatus used by Mr. Robert Jones is borne out by practice in war surgery.

In every way the book is a very able exposition based on first-class observation, and it stands to-day as the one real modern exposition of

if it is to tally with the method described.

The veterinary profession will smile at the paragraph on page 323 commencing "In veterinary medicine." The statement lacks accuracy, and the nomenclature is behind the times as regards epizootic lymphangitis. They might also be amused at the idea on page 17 of using the meiotagmin reaction to diagnose a case of foot-and-mouth disease!

In spite of this criticism, however, the book may be thoroughly recommended to anyone who wishes to understand the general principles of immunity and the practical application of serum and vaccines in human diseases.

Urinary Analysis and Diagnosis. By LOUIS HEITZMANN, M.D. Third edition. Royal 8vo. Pp. 345, 131 illustrations. London: Baillière, Tindall and Cox. 15s. net.

THIS book deals adequately, if not exhaustively, with the clinical examination of the urine, and has reached its third edition.

In the present volume, the chapters devoted to clinical examination of the urine have been expanded, and some new tests added. Microscopical examination and diagnosis receive especial attention, and the possibilities of diagnosis of the site of a urinary lesion, by studying the epithelial cells present in the urine, are fully considered. The author is a profound believer in the value of this part of urine examination.

A small section at the end of the book is devoted to the tests of the functional activity of the kidney, all of which, except the phenol-sulphonaphthalein test, he rules out as of little value. There is no danger, as the author appears to suppose, that the phthalein test will be used to replace chemical and microscopical examination. It is supplementary to these.

There are numerous illustrations, all of a diagrammatic character, but helpful to the novice. The book is a useful aid to clinical work, and should be widely read.

A New Treatment for Gonorrhœa. By C. Russ, M.B. Pp. vii + 38. London: H. K. Lewis and Co. 3s. net.

HAVING read the book through carefully, we are bound to find fault with the author's statement that gonococci cannot lie dormant. It is the experience of all that most of the cases of so-called re-infection are true recurrences, and we believe that the gonococci in these cases live at the expense of the leucocytes. It is a well-known fact that, in some chronic diseases in which recurrences are common, the causative organisms take up an intracellular habitat. The author's new treatment by electrolysis is interesting, and, when put upon a more rational and scientific basis, should prove a valuable adjunct to our already known and tried remedies for this disease. If the author intends to bring out another edition later, he should describe

slow to be cured. Would that, in this generation, we could behold our "City of Din" become a veritable "City of Dan."

Modern Medicine and some Modern Remedies. By THOMAS BODLEY SCOTT. Pp. 159. London: H. K. Lewis and Co. 4s. 6d. net.

IN the preface to this little book, Sir Lauder Brunton points out that most men engaged in busy general practice "carry their knowledge and power with them to the grave, and leave no record behind them by which posterity might profit." We are therefore the more grateful to Dr. Scott for his "Essays on Practical Medicine," which are the outcome of many years of strenuous work. All who have had the privilege of meeting him in consultation will have recognized that he was no ordinary man, and these essays are an outward and visible sign of his patient investigation of some of the problems confronting the practitioner. Though extolling some of the modern remedies, Dr. Scott pays a just tribute to the marvellous effect sometimes resulting from the administration of a combination of mercury, squills, and digitalis, commonly known as Baillie's pill. By the bye, this pill hails from St. George's Hospital, and not from Guy's or St. Bartholomew's, as he mentions.

Dr. Scott's wise words on prognosis should be borne in mind by every practitioner: "There is no important organ in the body so susceptible of nervous and mental influence as the heart; hope will buoy it up to make renewed and often successful efforts, despair will kill it." His experience has taught him that when signs of valvular implication have appeared, "very prolonged rest is most advisable; three months in bed or on the sofa is none too long in most cases." If only this wise counsel were followed, much subsequent heart trouble would be prevented. During this period of rest he is opposed to the use of digitalis, strophanthus, convallaria and spartein, but says that he has had much help from the use by the mouth of tablets made from supra-renal extract. His "Essay on Arterio-Sclerosis" is full of valuable information as to the best methods of treating this grave condition. His caution that the personal element in the equation should be considered before means are taken to lower blood pressure is one that needs attention.

Dr. Scott's remarks on hypothyroidism are most suggestive. He advises the combination of supra-renal with thyroid extract in cases in which the latter, given alone, causes cardiac symptoms. He has found thyroid extract of great service in senile degeneration, and he gives particulars of a most instructive case.

We have picked out a few of the points emphasized in these essays, but they are so full of practical and sage advice that we would urge all practitioners of medicine to "read, mark, learn, and inwardly digest them."

bone surgery.

Collected Papers on Analytical Psychology. By C. G. JUNG, M.D., LL.D. Authorised translation edited by Dr. CONSTANCE E. LONG. Pp. 392. London: Baillière, Tindall and Cox. 12s. 6d. net.

THE Zurich School of Psychology and its followers, while supporting the general principles of psycho-analysis, differ in certain directions from the views originally put forward by Freud, and the reader will find these differences clearly set out in the interesting preface contributed by Dr. Jung. The different chapters of the book contain a great deal of matter that has a practical bearing on the treatment of disorders of mind, and the section dealing with the association method, which has been especially developed by the Zurich School, will be found to be particularly instructive.

As to the general value that is placed on the contents of the book, much will depend upon the view taken by the individual reader towards the method of psycho-analysis. In any case, the contents, representing, as they do, the results of Jung's work over a series of years, form a valuable contribution to the subject, and cannot fail to be of interest to psychologists, even though they may not be in keeping with all their ideas.

The City of Din: A Tirade against Noise. By DAN MCKENZIE, M.D. Pp. 115. London: Adlard and Son. 3s. 6d. net.

Most pioneers are born before their time, and the reward of their labours is reaped by those who come later. Only a minority, among whom may be counted Lister, Darwin, and Huxley, is privileged to see the ideals for which they fought become *faits accomplis*. Many, like Roberts and Kitchener, are not permitted to see the realization of effort, whole-hearted, unceasing, and unselfish. Raleigh kept one bright star, the star of British colonization, steadily before him throughout the battles of his chequered life, but fell a victim to the worst king that ever sat on a throne a good 200 years before his dreams became realities. But, even though the pioneer sinks to his rest unrewarded in his lifetime, he may die satisfied that the cause he so ardently championed must one day be triumphant. Such a cause is that advanced by Dr. Dan McKenzie in his "City of Din," designed as a plea for the elimination of unnecessary noise in our great cities. Pithily and wittily written, it is a book to be read by every citizen, and then to be pondered over, and not merely laid aside as the pleasant beguiler of an hour. There is scarcely a single citizen of London who cannot contribute his mite to the making of a quieter and, as a result, more comfortable city. There can be no doubt that the increase of noise, disturbing to sleep, racking to nerve, and distracting to thought, has become a factor needing stern remedy in this whirling century. Whether, however, Dr. McKenzie will live to see his plea satisfied is doubtful, for evils insidious and slow in their origin are

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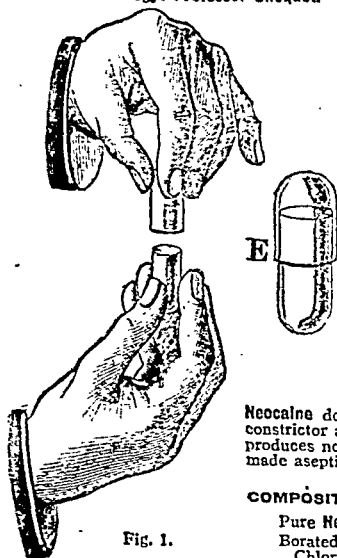


Fig. 1.

Neocaine is a synthetic product of French manufacture. It is in form of a white powder, belongs to the Benzoyl Dimethyl Ethyl series and is easily soluble in cold water. Neocaine possesses all the therapeutical qualities of Cocaine (excepting as an exhilarant) but only $\frac{1}{5}$ of its toxicity.

The Anæsthetic power of Neocaine is quite equal to that of Cocaine; also its duration and rapidity of action.

Neocaine does not like Cocaine exert a vaso-constrictor action, but is a cardiac tonic. It produces no local irritation if the injection is made aseptically.

COMPOSITION OF NEOCAINE-SURRENINE.

Pure Neocaine - - - 1 gramme
Borated Adrenalin
Chloride (Takamine) 2 milligrammes



Fig. 2.

Neocaine-Surrenine may be obtained in:—

- * 5 centigramme doses, each in sterilized double capsule; easily pulled apart (Fig. 1 E.)
 - * Tube containing 10 5-cg. doses of the powder in capsules (Fig. 2.)
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- * Not suitable for export to hot, humid climates; for this purpose, powder in tubes or solution in ampoules is recommended.

READY-PREPARED SOLUTIONS IN AMPOULES.

- Ampoules of 1 cc. each containing 5 cg. of Neocaine-Surrenine (solution 1 in 20).
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- Flask of 10 ccm. with patent stopper, containing sterile solution of Neocaine-Surrenine (1 cc. = 5 cg. solution in 20).

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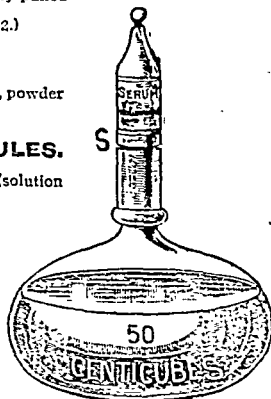


Fig. 3.

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Preparations, Inventions, etc.

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It is readily soluble in water, and is issued in capsules each containing 5 c.g. of the powder, made up in the proportion of 1 grm. of pure neocaine and 2 m.g. of borated adrenalin (Takamine). With the glass tubes, containing 20 doses of the powder, are issued as well small matrasses of sterilized isotonic solution, 5 c.c. and 10 c.c., so that it is possible to prepare 1 per cent. and 0.5 per cent. solutions readily and quickly.

PRIZE OF 50,000 FRANCS FOR A MECHANICAL HAND.

The Société Nationale de Chirurgie de Paris has been offered, by a generous donor who wishes to remain anonymous, a prize of 50,000 francs to be given to the maker of a mechanical apparatus which is the best substitute for the hand. All competitors must belong to allied or neutral nations. They must produce before the Société de Chirurgie maimed men, who have been wearing and using their apparatus for at least six months. The Société will then submit the apparatus to experiment for as long a time as may be deemed necessary. The apparatus awarded the prize will remain the property of its inventor. The competition will be closed two years after the end of the War.

The committee elected by the Société to act as judges consists of MM. Faure, Kermisson, Quenu, Rieffel and Rochard. Each competitor is requested to send his apparatus, together with a written description, to M. le Secrétaire Générale de la Société Nationale de Chirurgie, à Paris, 12, Rue de Seine.

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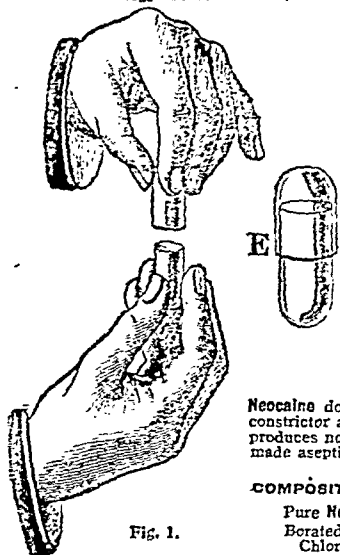


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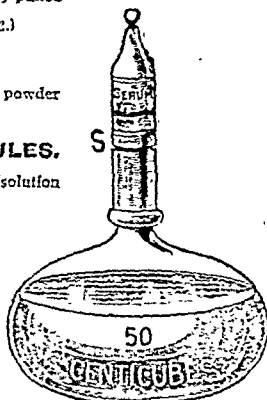


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- ADAMS, ALFRED, M.A., M.B., B.Ch.** Oxon., L.R.C.P. Lond., M.R.C.S., appointed temporarily Medical Officer for the Looe District by the Liskeard (Cornwall) Board of Guardians.
- ANDREWS, WILLIAM HENRY,** L.R.C.P. & S. Edin., L.F.P.S. Glasg., appointed Acting Deputy Medical Officer for the Thirteenth District of the Kingsbridge (Devon) Union.
- BARNES, FRANK, M.B., M.S. Lond.,** F.R.C.S. Eng., appointed Honorary Surgeon to the General Hospital, Birmingham.
- BROWNE, W. M., L.R.C.P. & S. Edin.,** appointed District Medical Officer of the Tiverton and Honiton Unions.
- CAREGAN, O. J., L.R.C.P. & S. Edin.,** appointed Certifying Factory Surgeon for the Ormskirk District, co. Lancaster.
- CARLYLE, P. M., M.B., C.M. Edin.,** appointed Certifying Surgeon under the Factory and Workshop Acts for H.M. Factory at Gretna, in the counties of Cumberland and Dumfries.
- DELVIN, J. F. P.,** appointed Certifying Surgeon under the Factory and Workshop Acts for the Gortin District of the county of Tyrone.
- DRIVER, Miss H. A., L. & L.M.R.C.P.S.I.,** appointed Assistant Medical Officer of the Bolton Union Workhouse.
- DYBALL, BRENNAN, M.B., B.S. Lond.,** F.R.C.S. Eng., L.R.C.P. Lond., appointed Honorary Surgeon to the Royal Devon and Exeter Hospital.
- FIELDEN, E., M.B.,** appointed District Medical Officer of the Easthampstead Union.
- GRIFFIN, J. P., M.R.C.S., L.R.C.P.,** appointed District Medical Officer of the Hitchin Union.
- HAWKSWORTH, Mr.,** appointed Deputy Acting Medical Officer to the Exmouth District for the St. Thomas (Exeter) Board of Guardians.
- HEIFFTON, EDITH, L.R.C.P. & S. Edin., R.R.F.P. & S. Glasg.,** appointed Medical Officer to Munition Girls' Factory, Corringham, Essex.
- HENSHAW, W. H., M.R.C.S., L.R.C.P.,** appointed Medical Officer of the Tame Street Institution of the Manchester Union.
- LAUDER, HELEN, L.R.C.P., L.R.C.S. Edin., L.F.P.S. Glasg.,** appointed Medical Officer to the Hyde Education Committee.
- MALCOLM, R., M.D. St. And.,** appointed Medical Officer for the Bolton-on-Dearne and Thurnscoe District.
- MARRIOTT, F., L.M.S.S.A.,** appointed Certifying Surgeon under the Factory and Workshop Acts for the Tibshelf District of the county of Derby.
- MOIR, D. R., M.B., Ch.B. Aber.,** appointed Medical Officer of the Receiving and Scattered Homes of the Kingston-upon-Hull Incorporation.
- MORE, J., L.R.C.P., M.R.C.S.,** appointed Certifying Factory Surgeon for the Rothwell District, co. Northampton.
- Dr. OSMOND,** appointed Public Vaccinator for Hale, by the Redruth (Cornwall) Board of Guardians.
- PATTERSON, NORMAN, M.B., F.R.C.S.,** appointed Assistant Surgeon to the Throat and Ear Department at the London Hospital.
- PETTY, A. J., M.B., B.C. Camb.,** appointed Certifying Factory Surgeon for the Longton District, co. Lancaster. (Correction.)
- RIDDELL, W. A., M.B., Ch.B.,** appointed District Medical Officer of the Birkenhead Union Infirmary.
- SCOTT, F. S., M.B., B.S. Lond.,** appointed District Medical Officer of the Truro Union.
- SMALE, OSWALD RIDLEY, B.A., M.B., B.C. Cantab., L.R.C.P., M.R.C.S.,** appointed Acting Deputy Medical Officer for the Linkinhorne District by the Liskeard (Cornwall) Board of Guardians.
- STUMP, C. (final-year student)** appointed, Resident Physician at the Royal Infirmary, Edinburgh.
- STURDEE, EDWIN LAWRENCE, M.R.C.S., L.R.C.P.,** appointed Acting Deputy Public Vaccinator to the Exmouth District for the St. Thomas (Exeter) Board of Guardians.
- WYNNE, J. DARLEY, M.B., B.Ch., M.R.C.S.,** appointed Medical Officer of St. Faith's Workhouse and District Medical Officer of St. Faith's Union, Norwich.

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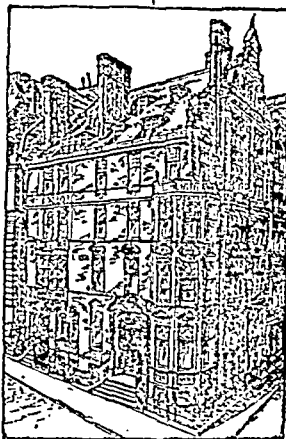
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*The Session 1916-17 begins on Monday,
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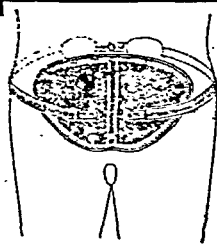
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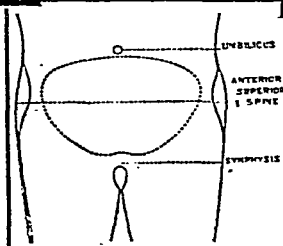
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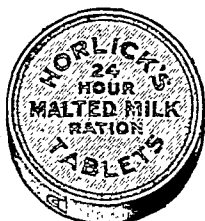
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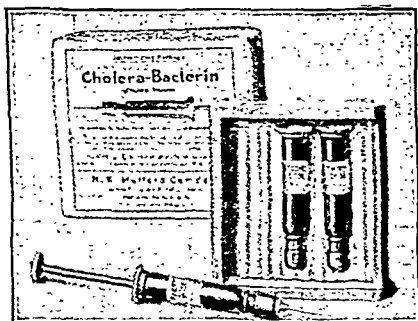
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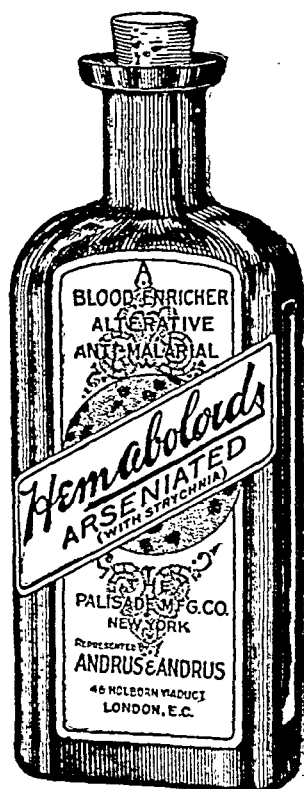
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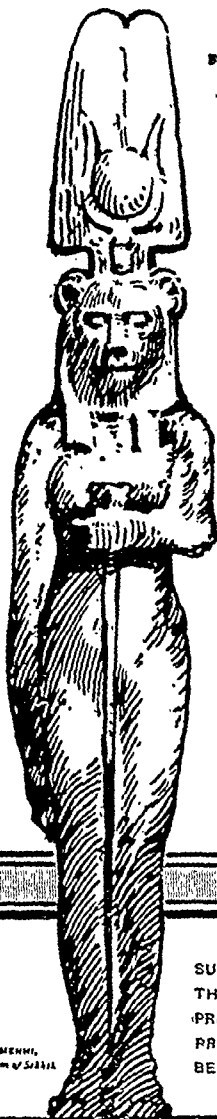


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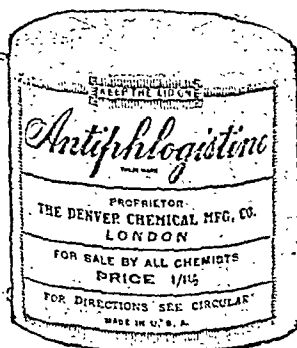
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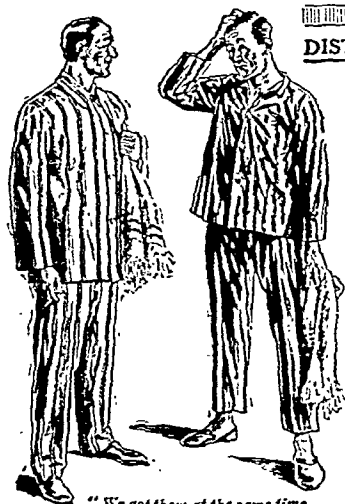
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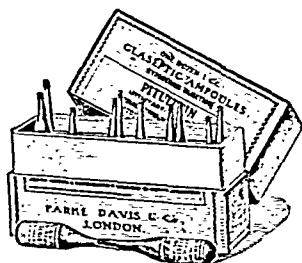
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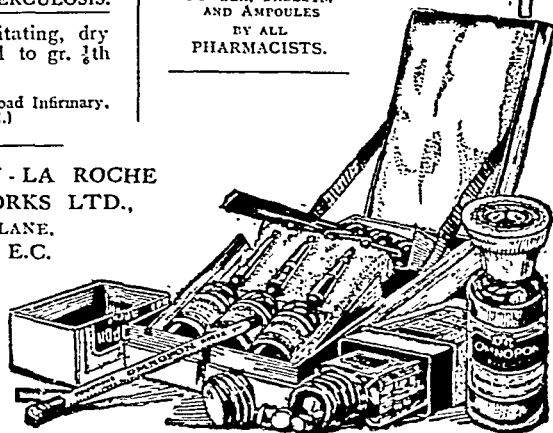
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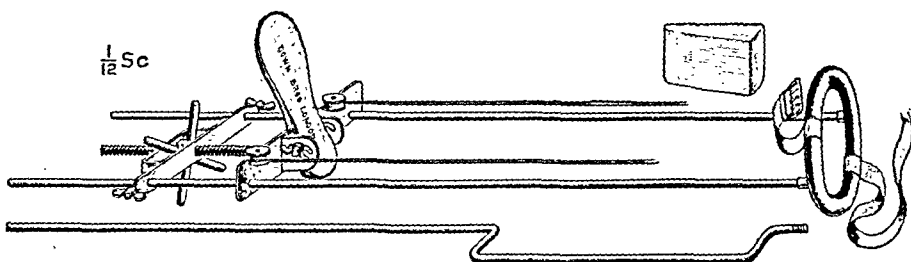
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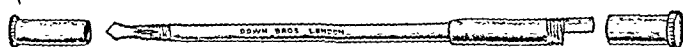
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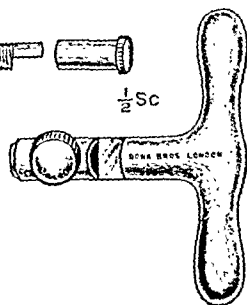
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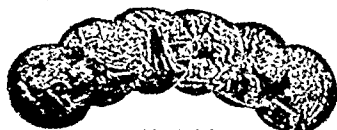
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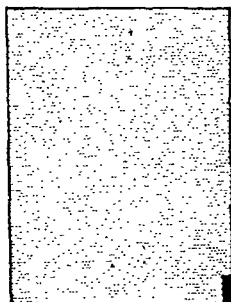
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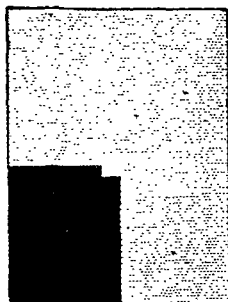
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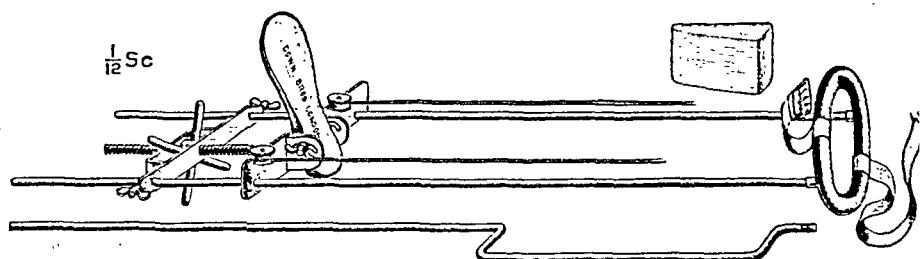
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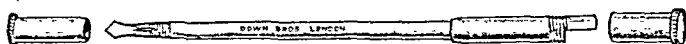
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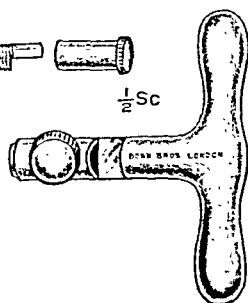
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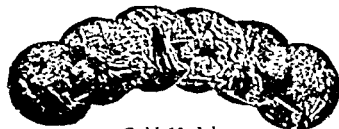


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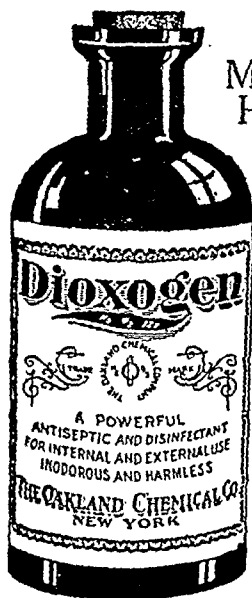
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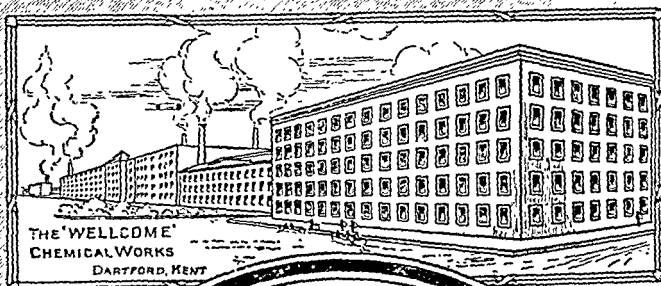
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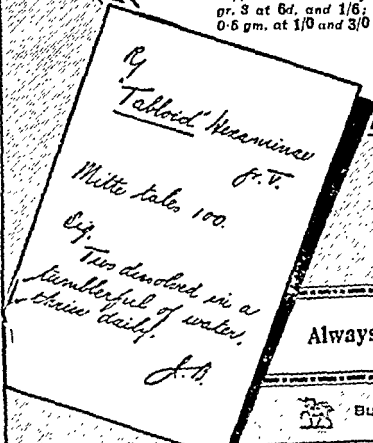
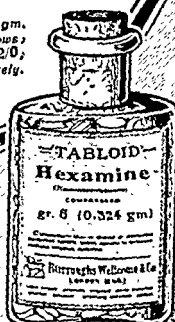
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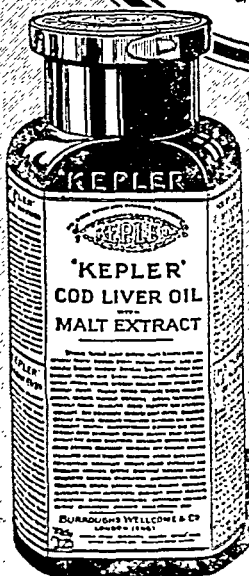
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By C. A. HOEFFTCKE, 21, Woodstock Street, Oxford Street, London, W.

Mrs. C. G., wife of a doctor and mother of three strong, healthy sons. She is now (1915) 61 years old, and had always enjoyed good health until November, 1903, when she had a bad attack of septic tonsillitis with multilocular abscesses. Consequent upon this she developed pyorrhœa alveolaris of a severe type. In October, 1905, she was suddenly seized with sharp pain in the right wrist, which was quickly followed by swelling of the carpal and carpo-metacarpal articulations and fusiform distortion of the fingers of both hands. A little later both knees and both ankles became involved (the right ones first). Medical treatment was at once begun, but drugs had little or no effect on the course of the disease. A series of baths at Bath were "comforting," but still the disease progressed. In the spring of 1907 she left London for the South Coast, and tried a course of Lathom's blistering treatment and radiant heat baths, the result of which, as well as of another series of baths at Bath, was most disappointing. After a long course of drug treatment she was given up in September, 1910, as a hopeless case by one of the leading London specialists. Thereupon vaccine treatment by means of an autogenetic vaccine, obtained from pus from the gums, was commenced, and has been continued until quite recently. Great improvement in general health followed quickly and the disease was practically arrested, but the damage already done, especially to the knee-joints, was so great that she broke down completely in February, 1913. The movement of the grating joints was so painful that she took to her bed fully convinced that she would never walk again.

At the end of August, 1913, her husband decided to try Mr. Hoefftcke's splints, and on Sept. 14th Mr. Hoefftcke (having previously seen the patient and given a hopeful prognosis) put them on for the first time. On Oct. 1st, under an anæsthetic, the legs were hyper-extended at the knee-joints and the contracted femoral adductors were stretched (on *Hoefftcke's Extension table*), the limbs being then put up in plaster-of-Paris with extension weights to both feet. A few days later the plaster was removed and the splints, with full extension re-applied. At the end of the month she could walk with assistance and was getting quite accustomed to the splints. On Dec. 24th she dispensed with the services of her trained nurse and was able to walk on the level with the aid of one stick. On Feb. 28th, 1914, she was able to walk upstairs for the first time for a whole year without any assistance. In June, 1914, she could walk for one and a half hours without resting. On June 17th, 1915, Mr. Hoefftcke removed the splints and allowed the patient to walk up and down the room without any mechanical assistance, which she was quite able to do. The splints were then re-applied, but *without the extension*, so that she bore her weight on the soles of the feet. Since then she has been able to walk for a mile at a stretch without any discomfort or fatigue and thinks nothing of going up and down a steep flight of stairs half-a-dozen times a day.

Here, then, was a case in which the cartilages of the joints of the lower limbs were badly eroded, there was much thickening of the synovial membrane, with peri-articular infiltration and deformity. The joints were hot and painful as the result of persistent efforts to continue using them. There was also fluid in them and the patellæ floated. Now the limbs are straight, the joints are no longer deformed, nor do they grate, the muscular power of the extensors has returned, and in a brief space she hopes to discard the splints entirely. She will, however, always feel grateful to them and their inventor, for beyond the shadow of a doubt she would have been a hopeless cripple for life had not Mr. Hoefftcke's treatment been adopted.

This description of his own wife's case was kindly given to me last year by a doctor. The splints were applied on Sept. 14th, 1913, the knees were straight three weeks later, the splints were left off in June 1915, and now after a lapse of 14 months there is no recurrence of the old trouble, free movement, full flexion and extension has been obtained as the result of the extension treatment.

THE PRACTITIONER.

SEPTEMBER, 1916.

ABDOMINAL WOUNDS IN WAR.

BY COLONEL CUTHBERT WALLACE, A.M.S., F.R.C.S.

Consulting Surgeon to the Expeditionary Force.

A "PAST" may or may not be a good thing for an individual, and the same may be said of surgery.

A "past" began by handicapping abdominal surgery in this campaign. The experience of South Africa was taken as proving the impossibility of obtaining good results in abdominal wounds, yet Makins, in his *Surgical Experiences in South Africa*, says: "Perforating wounds of the small intestine are very fatal injuries. Every person in whom this condition was certainly diagnosed died." An ounce of practice is said to be worth a pound of theory, but this time theory has proved right, for what surgeon would say that, theoretically, an abdominal wound ought not to be explored? Would any surgeon in civil life tell his house-officer to put a man, shot in the belly, to bed and look at him? How was it that South Africa dominated the situation? The reason was, I believe, threefold.

In the first place, the conditions were then so very different to what they are at this present moment, when the fighting line is stationary. It is well to remember that it was not always so, and may not be so in the future; but the conditions will never be quite the same as in South Africa, for we are in a thickly settled country with many buildings, where warmth and rest may be obtained, and, in addition, we have motor transport.

The second reason lay in the small numbers dealt with in Africa; the figures were not sufficient whereon to form a judgement. One of the difficulties in establishing operation as a routine measure in this war has been the disappointment felt by the operator when he experienced a run of bad luck. In several instances, runs of eight consecutive deaths

HOEFFTCKE'S EXTENSION APPLIANCES.

AMBULATORY TREATMENT OF ARTHRITIC DISEASE OF JOINTS.

By C. A. HOEFFTCKE, 21, Woodstock Street, Oxford Street, London, W.

Mrs. C. G., wife of a doctor and mother of three strong, healthy sons. She is now (1915) 61 years old, and had always enjoyed good health until November, 1903, when she had a bad attack of septic tonsillitis with multilocular abscesses. Consequently upon this she developed pyorrhœa alveolaris of a severe type. In October, 1905, she was suddenly seized with sharp pain in the right wrist, which was quickly followed by swelling of the carpal and carpo-metacarpal articulations and fusiform distortion of the fingers of both hands. A little later both knees and both ankles became involved (the right ones first). Medical treatment was at once begun, but drugs had little or no effect on the course of the disease. A series of baths at Bath were "comforting," but still the disease progressed. In the spring of 1907 she left London for the South Coast, and tried a course of Lathom's blistering treatment and radiant heat baths, the result of which, as well as of another series of baths at Bath, was most disappointing. After a long course of drug treatment she was given up in September, 1910, as a hopeless case by one of the leading London specialists. Thereupon vaccine treatment by means of an autogenetic vaccine, obtained from pus from the gums, was commenced, and has been continued until quite recently. Great improvement in general health followed quickly and the disease was practically arrested, but the damage already done, especially to the knee-joints, was so great that she broke down completely in February, 1913. The movement of the grating joints was so painful that she took to her bed fully convinced that she would never walk again.

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subsequently.

PROJECTILES THAT CAUSE THE WOUNDS.

The following table shows the relative numbers of the different missiles that are responsible for the wounds. It also shows the proportion retained in the body. "Shell fragment" means a portion of a high explosive shell that has been torn in bits by the explosive charge. "Shrapnel" means the leaden balls contained in such shells.

Bullet.		Shell Fragment.		Shrapnel.		Bomb or Grenade.	
Re-tained.	Passed out.	Re-tained.	Passed out.	Re-tained.	Passed out.	Re-tained.	Passed out.
68	128	55	9	32	8	27	2
196		64		40		29	

Total retained 182

„ passed out 147

Grand total 329

The period from which these figures are taken include both open and trench fighting. Perhaps the most striking fact is the large number of retained projectiles.

(1) *Bullets*, as one would expect, show the least number of cases of retention. At the usual range in this war, the bullet still has a great velocity, and is, by its shape, eminently fitted to pass through the body. The cause of the retention is most probably due to ricochets or to way being taken off the bullet by the previous penetration of sandbags or other objects. Its instability of flight may be another factor. Some wounds have been caused by deformed bullets or by the core or mantle. One serious instance may be quoted, which occurred in a case under the care of Major Cuff. A man was hit in the back in the sixth right intercostal space. He presented no symptoms of abdominal injury, but passed the core and mantle *per anum* on two consecutive days.

(2) *Shrapnel*, of which the individual balls vary in size, and whose penetration, as a rule, depends on the velocity of

have occurred after operation. Now eight abdominal penetrating wounds mean about 600 wounded, and this number was a comparatively large one for South Africa. It was, therefore, very easy for an operator to get a bad impression, and I believe that this actually happened in one action to the north of Bloemfontein. Again, we reckon that an operative mortality of under 50 per cent. is good; yet it is an awful mortality to face, and would depress a civilian surgeon almost past a renewed trial. But it means almost 50 lives saved.

The third reason is, perhaps, the most interesting of all. Among others, two officers, well known in the R.A.M.C., were shot through the epigastrium and recovered. This fact became widely known, and has tinged surgical opinion up to this war. These cases were frequently quoted, and they were living examples of the success of the expectant treatment.

EARLY OPERATION.

The advisability of early operation, in the great majority of gunshot wounds of the abdomen, may now be said to be established on a firm basis. The reasons for this change have been given in the *Lancet*, December 18, 1915. The question is now: What cases are best left alone?

In a large series of cases, there will be many that are past help. In 511 cases, there were 145 in which any surgical operation was out of the question. Of the remaining 366 patients, no operation was considered advisable in 56 instances. Of this latter number, 15 cases were, in all probability, wounds of the liver. Some were cases of doubtful abdominal penetration, which arrived late, and presented no symptoms suggesting involvement of a hollow viscus.

A few were cases of uncomplicated traumatic hæmaturia. Wounds of the liver furnish most of the cases of undoubted penetration which it is advisable to leave alone. The kidney furnishes a few as well, and about the propriety of leaving both these alone there is no difference of opinion. All are agreed, too, that wounds of the small gut area should be explored. There is still some doubt about the best course to pursue in cases of suspected stomach injury, and in wounds which apparently involve only the colon. These will be referred to

thick muscles of a man's back and injuring the intestine. Like those of the high explosive shell, the fragments, dispersing centrifugally, cause wounds in all directions.

REGIONAL INCIDENCE OF WOUNDS AND THEIR RELATIVE DANGER.

A chart made of some hundreds of abdominal injuries shows that two-thirds of the projectiles enter anterior to the lateral line of the body, when viewed from the front, and one-third behind this line. On the whole, the posterior wound is the more dangerous. Projectiles may enter the body as far away as the top of the shoulder or the sole of the foot.

Speaking of those cases which are submitted to operation, it can be said that an antero-posterior wound in the upper part of the abdomen is the least dangerous, and a side-to-side wound lower down the most dangerous, though there is little to choose between the latter and antero-posterior hypogastric or buttock and hip wounds. A chart made of a large series of cases that were too bad for operation, and in which a single entry wound was represented by a dot, and an in-and-out wound by a line, shows a darkened fan-shaped area, the apex of which is in the left costal margin. This chart seems to show that, of the cases that come under observation, the most dangerous wound is one of the left lower hypochondrium or upper lumbar region, for many such cases are too bad for operation. A chart with all the entrance wounds plotted shows a tendency for the dots to collect towards the sides of the body. This is probably connected with the presence of the great vessels in the mid line.

COMPARATIVE FREQUENCY OF WOUNDS OF DIFFERENT VISCERA.

	Alone.	With other Hollow Viscera.
Stomach - - - -	16	7
Small Gut - - - -	69	21
Great Gut - - - -	61	12
Liver - - - -	42	6
Kidney - - - -	7	6
Spleen - - - -	6	5
Bladder - - - -	10	3

These figures only apply to operated cases. As many liver

the shell at the moment of bursting, does not call for any particular comment. The injury inflicted is very much what would be expected. It makes a larger hole, both in the belly wall and in the hollow viscera, than does a bullet, and the edges of the wounds are more excoriated and bruised.

(3) *Shell fragments* present altogether different characters from bullets or shrapnel balls. They are formed by the rending in pieces of steel shells by the contained high explosive. Their velocity, therefore, depends on the contained charge, which is exploded either in the air, as in the case of shrapnel, or by a percussion fuse on contact with the ground or other object. The fragments into which the shell bursts are of all possible sizes, dependent, in some degree, on the size of the shell. The fragments, with which the abdominal injuries concerned are caused, are not, for obvious reasons, very large—commonly under one inch in greatest extent, often much smaller. Their chief characteristics are rough surfaces and sharp edges. They are eminently suited to produce ragged wounds, but their inequality of surface and, in many cases, small size will render penetration difficult, and probably accounts for the large proportion of retained fragments.

The shell, when it bursts, scatters the fragments in all directions, so that a man may be wounded if the shell bursts beyond him as well as if it bursts in front of him. When the burst takes place on the ground, fragments will travel upwards and pass through the body in an upward direction. To quote a case: An officer was riding along a road when a shell hit the surface close to him. A fragment entered the buttock as he sat on the horse and emerged in the left iliac region. It cut the small intestine in many places as well as the mesentery, from which fatal bleeding took place.

(4) *Bombs. Grenades.*—These are of very various kinds, but they all disintegrate into numerous fragments, which are, as a rule, small, often tiny. In the earlier part of the trench warfare, they contained all sorts of things, from scrap iron and bolts to cobblers' nails. Now the wounding fragments are mostly formed by the disruption of the body, which is ringed with grooves to help the rupture into small fragments.

The chief characteristic is the extreme velocity acquired by the fragments which, though no bigger than a match head, possess great powers of penetration, passing through even the

alone, have got well; but this must not be taken to mean that the gravity of abdominal wounds, in which the colon is wounded, has been increased by operation. Even if more vertical wounds are lost, those of the transverse colon and those in which the small gut has been injured have a much better chance.

The reason of losing some vertical colon wounds is brought about in the following way: A man is hit in the flank, and there is no exit wound. The abdomen is rigid, and the pulse raised. No one can say which organ is wounded. The abdomen is opened to find out. The small intestine is explored and found uninjured, but the colon is found opened near the flexure of the peritoneum. The manipulation necessary to establish the immunity of the small gut may lead to the infection of the general peritoneal cavity, which might have escaped had the man been left alone. The loss in one direction must be balanced by the gain in another.

About stomach wounds, it is difficult to be dogmatic at present, but, except in certain cases to be mentioned later on, I am in favour of operation. Experience has shown that hæmorrhage from vessels feeding the stomach is much to be feared, and if a patient is left, because he has apparently only a stomach wound, the favourable moment for dealing with the hæmorrhage may be passed before the signs of anæmia declare themselves. In addition, there may be lesions of other organs that prove fatal. To quote one case to show how dangerous an epigastric wound may be: A patient was admitted with a wound through the left sixth costal cartilage. He died, and it was found that the projectile (a piece of shell apparently) had cut the lesser curvature, passed through the gastro-hepatic omentum, and shattered the hilum of the left kidney, opening the vessels, from which a fatal hæmorrhage had taken place.

SOLID VISCERA.

Many liver wounds heal well. Those that are fatal or bleed much, involve the big veins in the organ. Oozing from the wounded surface generally stops in a few hours, but may go on for as long as eleven hours. Some wounds are mysteriously fatal. Thus one patient, shot through the right hypochondrium—the bullet taking a comparatively super-

wounds are intentionally left alone, another 15 cases should be added to get the proportion approximately correct.

COMPARATIVE DANGER OF WOUNDS OF DIFFERENT VISCERA.

Of the cases that arrive at the casualty clearing stations, it can be said that wounds of the solid viscera are very much less fatal than those of the alimentary tube. When a fatal result ensues, the cause of death is, for the most part, hæmorrhage. There is some evidence to show that wounds of the spleen and kidney-vessels and of the liver veins are fatal before the cases reach the operation table.

HOLLOW VISCERA.

Wounds of the small intestine show a mortality of 63·8 per cent. ; the large intestine, 60 per cent. ; the stomach, 43·75 per cent., while the total hollow viscera mortality is 64·5 per cent. This latter mortality shows the increased danger of multiple injuries, and is largely accounted for by colon injuries complicating those of the stomach and small gut.

The small gut injuries are serious from their multiplicity, the large gut injuries from their infectivity. To put it in another way, a small lesion of the small intestine can easily be dealt with by the surgeon with a fair amount of confidence that no septic trouble will follow. The same cannot be said of the large intestine, where a small wound is very likely to prove fatal from peritonitis. In addition, a small intestine wound is easy to find and easy to repair, but a wound of the large intestine is often difficult both to find and to repair.

Under the old conditions, it is most probable that wounds of the vertical colon were, next to some stomach wounds, the least to be feared, and a fair number of these, according to Makins, reached the base. The explanation lies in the fact, put forward by Makins, that the infection caused by the colon leads to a local peritonitis which saves the general cavity from infection, and paves the way for the establishment of a fæcal fistula through the exit or entry wound in the abdominal wall.

Under the present system of opening the abdomen, it is possible that some colon wounds are fatal, that might, if left

alone, have got well; but this must not be taken to mean that the gravity of abdominal wounds, in which the colon is wounded, has been increased by operation. Even if more vertical wounds are lost, those of the transverse colon and those in which the small gut has been injured have a much better chance.

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ficial course—came in profoundly shocked and died. After death, the only lesion was a comparatively superficial furrow ploughed in the external surface of the organ. I have seen other cases in which death occurred from a similar wound.

The kidney is often wounded and recovers spontaneously. The dangerous wounds are those that enter the hilum and involve the vessels.

It must be remembered that a certain number of cases, both of liver and kidney wounds, that are sent to the base, suffer from severe secondary hæmorrhage, which is fatal.

Very few wounds of the pancreas come under the care of the surgeon. It is possible that many are fatal from involvement of the great vessels. Many wounds of the spleen heal spontaneously, as post-mortems at the base have shown. The dangerous cases are those in which the vessels are injured.

Wounds of the bladder are not dangerous if uncomplicated.

SHOCK.

Subjective Sensations.—The sensations of a man shot in the abdomen vary in a remarkable degree. As can well be imagined, the size of the projectile must have a considerable influence. A large fragment of shell or a fuse cap produces the same effect as a violent blow from the heels of a horse, although there may be no open wound, and the subsequent course proves that there was no internal injury. A somewhat similar effect is produced when a portion of the abdominal wall is torn away, but as, in this case, the blow is more or less a glancing one, the amount of "knock-out" effect is less, often surprisingly little. Men have walked considerable distances with such wounds, and their intestines supported by a bandage. Sometimes a man, although he knows he has been hit in the abdomen, is quite unconscious that his intestine is prolapsed, although a considerable amount may be outside the body. To quote a case: A man had his abdominal wall ripped open by a bullet just as we were compelled to evacuate a trench. He was bandaged with a shell dressing, and insisted on walking himself to a trench in the rear, where he lay on the fire-step for some time until things became quiet, and he was able to be taken away to the

ambulance. He made a complete recovery.

When the missile is a small one, and penetrates and wounds the intestine, there may be very little pain or disturbance produced. One man hit in the iliac region, and in whom subsequent operation proved intestinal injury, was quite unconscious that he had received a severe wound. He thought he had been hit in the leg, the bullet having bruised some of the lumbar nerves. Another man, a bearer in the R.A.M.C., who had been hit in the abdomen, and, as proved by a subsequent operation, the gut wounded, was brought to an advanced dressing station, but seeing that there were many wounded to be attended to, had got up from his stretcher and lent a hand. To quote another case: A man was hit just above the pubes. He experienced very little inconvenience. When the first dressing was applied, some small gut lay on the belly wall. This was covered up, and the man taken straight to hospital. When he arrived there, he was in good condition and in no pain. Six or seven feet of the small gut, perforated in places, were lying under the dressing. He made a complete recovery. The absence of pain and shock in prolapse of intestine is well known in animals.

On the other hand, a man shot in the abdomen by a bullet, or some smaller projectile, may experience a tremendous blow which may or may not knock him out. The sensation of a tremendous blow or kick is experienced when even small missiles wound the limbs, which are not furnished with a delicate sympathetic system. It is curious to remember that the blow or kick sensation is experienced by rheumatic people who rupture muscle fibres while playing games. It is legitimate, therefore, to imagine that the sensation of a violent blow is a thing apart from an injury to the solar plexus.

Pain of an intense character is not infrequently felt directly after the wound has been received. It accompanies wounds both in the upper and lower abdomen; in the latter case, it is especially connected with penetrating buttock wounds, and is a valuable sign in calling attention to the dangerous nature of such lesions. The suddenness of the pain recalls that seen in perforation of a gastric ulcer or the onset of an appendicitis. This similarity suggests that the

cause of the pain is connected with an irritation of the peritoneum by infective material, though the escape of such matter is often not perceptible at the operation. Major Don, R.A.M.C., thinks that the acid contents of the upper bowel may be concerned in the production of the pain.

The following is an example of intense sudden pain and the board-like rigidity that so often accompanies it :—

L. C. was wounded in the back by a rifle grenade. He was admitted within four hours of the wound. His pulse was 60, but he was pale and suffering intense pain in spite of morphia. His abdomen was like a board. He was taken to the theatre, and, when examined, the only wound found was a small puncture, not larger than a safety-match head, on the outer side of the erector spinal muscle. The abdomen was opened, and one abrasion and three perforations of the jejunum were found, in the last of which the grenade fragment lay. There was no visible escape of contents. The wounds were sutured, and the belly closed. Recovery was uninterrupted. The fragment that caused the injury was smaller than a large safety-match head in bulk, and was so small that its weight could scarcely be appreciated by the hand.

Shock Proper.—When shock proper, as distinct from a man's sensations, is considered, the variations are very great too. If the projectile is large, it will, from the actual blow, produce the shock that any blow on the abdomen is liable to cause. Again, extensive injuries to the belly may cause well-marked collapse. This is true as well of multiple injuries to the abdominal viscera. Apart from these generalizations, it is very hard to make any definite statement as to the relation between the amount of shock present on the one hand, and the organs injured and the amount of individual damage on the other.

Regimental medical officers, who see the cases early, can form no idea (apart from loss of abdominal wall or perforation of viscera) what the extent of the abdominal injury is, and by the time the cases come to operation, there are the added factors of loss of blood and peritonitis.

Apart from very extensive injury, the amount of shock seems to be in great part due to loss of blood, and, at a later stage, to peritonitis. Some comparative superficial lesions of the outer surface of the liver seem accompanied by extreme shock, sufficient to cause death without any marked loss of blood. Stripping up of the retro-peritoneal tissue by

blood causes collapse out of proportion to the amount of blood effused; possibly, this is due to sympathetic injury.

Again, wounds of the pancreas are so rare as to lead one to believe that this is a very fatal occurrence, though the proximity of this organ to the great vessels is another possible explanation. Wounds of the spleen or kidney, apart from hæmorrhage, do not seem to produce much shock. This is, perhaps, rather curious, when one remembers the effect of the kidney blow in boxing.

The great pain of a small injury will produce pallor and collapse with cold extremities, but the pulse is often quiet and good, notwithstanding the appearance of the patient. It is well to be on one's guard not to confuse the effects of septic infection of the retro-peritoneal tissue and of "gas" infection of the abdominal wall with true traumatic shock, for they may both be present within a few hours of injury.

WOUNDS OF THE HOLLOW VISCERA.

The stomach affords many types of wound, but nearly all are easily explained. The wounds may involve both anterior and posterior surfaces, or only one of these. As a matter of fact, the small double perforation, which has been regarded as typical of stomach wounds, is not so frequent as a wound of the anterior surface, though possibly more common than one of the posterior surface.

When the organ is hit by a bullet passing in a fairly true antero-posterior direction, two small perforations are the result. If towards the top or bottom of the stomach, the greater or lesser curvature may be only just involved and a single hole result. A little higher up or lower down and the stomach escapes actual injury, though the vessels supplying it may be cut, and much hæmorrhage result. A bullet just above the lesser curvature will cause an external wound, the situation of which will justifiably add to the assumption that the stomach has been injured, and it is likely that many of the observed recoveries from a stomach lesion belong to this category. This does not mean to say that no wounds of the stomach have undergone spontaneous recovery, for the observations at the base point in the opposite direction. If the projectile passes obliquely, its track becomes more or less

parallel to the anterior surface, and a longer or shorter wound results. In some cases, the projectile enters the organ and again quickly emerges, causing what may be called a "note of exclamation" wound.

Again, a bullet entering near the mid-line behind and emerging about the mid-axillary line is likely to take up the posterior wall of the organ. If at all high up, such wounds are very hard for the surgeon to reach, let alone to mention suture. I have in mind two such cases, in which vomiting and rigidity of the upper abdomen seemed to point to a stomach lesion. Both were sent to the base doing well. Injuries of this class, along with posterior wounds in the lower thorax, which possibly may have injured the stomach near the œsophagus, are the only stomach wounds in which I advise the surgeon to hold his hand, and only for the reason of the extreme difficulty with which they can be surgically dealt.

Occasionally, one meets with small entrance and large exit wounds that have been caused, apparently, by bullets—the so-called "explosive wounds"—and sometimes the pyloric portion of the stomach is severed by an obliquely side-to-side passing bullet, but, with these exceptions, the wounds are usually commensurate with the size and direction of the bullet. Shell fragments, as would be expected, make wounds in proportion to their size and shape.

Wounds of the stomach often bleed freely, and many cases are lost, after successful suture, from the effects of primary hæmorrhage. Secondary hæmorrhage is, or rather has been, responsible for death, as well as a later secondary hæmorrhage which has occurred after unoperated cases have arrived at the base.

In the *British Medical Journal*, April 8, 1916, Major T. R. Elliott and Capt. Herbert Henry made some very important remarks on the after-history of both operated and unoperated gastric wounds. They show that sutured and unsutured wounds and contusions are subject to ulceration, secondary hæmorrhage, and perforation.

The secondary hæmorrhage occurred on the sixth, tenth, twelfth, and fifteenth day respectively. Death occurred on the ninth, thirty-sixth, and thirty-fifth day, the first from hæmorrhage and the last two from peritonitis. They point

out as well, that more wounds of the right lower chest reach the base and die there than wounds of the left lower chest. This is interpreted as meaning that the left lower chest wounds are more dangerous and die at the front. This is very interesting, and gives support to my own impression that stomach wounds are dangerous, because of association with other lesions. Wounds of the spleen and stomach are not often seen at operation, and the close association of the left lower thorax and the spleen and stomach may account for the disparity of deaths at the base from left lower chest injuries. It has also been pointed out that, in many cases that arrive too bad for operation, the missile passes in part of its course through this neighbourhood.

SMALL INTESTINE.

These injuries vary from a small perforation to complete division or complete destruction of a portion of the tube. Bomb wounds are nearly always small, and often multiple. They are, as a rule, smaller than bullet wounds. They are very favourable, provided they are not too multiple, for they nearly always lend themselves to suture.

Small shell fragments produce very similar wounds, though perhaps the number of perforations is not so large.

Large shell fragments produce more serious wounds—some small, some large, and often complete division of the bowel.

Bullets cause all sorts of injuries, and often they are as severe as those caused by the larger shell fragment. From an examination of the bowel, it could not be said whether a bullet or shell had caused the lesion. There may be a small round perforation or there may be many such holes, and they may be even or uneven in number. Sometimes, with an uneven number of holes, the missile is found within the lumen. Apparently, the projectile passes in and out of the intestine. At times, the holes are so small that they only just admit a bullet; at other times, the holes are larger on both sides, pointing to an oblique passage through the intestine. At another time, there will be a series of gashes, nearly always more or less transverse to the axis, pointing to the bullet passing along the wall from mesentery to free border or *vice*

versâ. Bruises and tears of the serous or serous and muscular coats are seen as well, where the bullet has passed between the coils without opening the lumen.

Longitudinal lesions are rare, though at times whole lengths of the gut are reduced to a ragged cord. Total divisions are by no means rare, and the edges are, as a rule, clean cut.

The mucous membrane prolapses or pouts through the rents, forming rosettes which are quite typical. Sections taken through the edges of the rent by Capt. J. W. McNee seem to show that the eversion is due to contraction of the longitudinal coat. Capt. Stevenson and Capt. McNee have shown, too, that the damage done is very local, the mucous membrane being normal up to the site of the rent. There is some, but no excessive, extravasation of blood into the muscle coat. A study of the sections suggested to me that there was scarcely more trauma than would be inflicted by a cut with a blunt pair of scissors. This state of affairs, no doubt, accounts for the kindly healing without excision of the wound.

LARGE INTESTINE.

The lesions of the large gut are not, as a rule, multiple. They may be anything from complete division of the tube down to a small single lesion. Many large and extensive tears are caused by shell fragments, but a bullet will completely divide the intestine. I have seen this division in the ascending, transverse, and descending colon, though not in the pelvic colon. A good many wounds are extra-peritoneal or partly extra- and intra-peritoneal at the line of the reflexion of the peritoneum off the colon. The latter wounds are very hard to find, and, if found, very hard to suture adequately. Such wounds are more often overlooked than any, although a careful search is made.

STATE OF THE DIFFERENT PARTS OF THE ALIMENTARY CANAL IN RESPECT OF CONTENTS.

While the amount of food in the stomach is directly dependent on the time of the last meal, the escape of the contents depends on this and on the size and situation of

the other hand, tend to limit escape.

An interesting observation was made the other day by Capt. John Fraser. A party of soldiers was shelled in billets just after the mid-day meal, which consisted of large quantities of tea. There were several cases of abdominal wounds, and Fraser states that the amount of fluid in the abdomen in some cases of wounded small gut was remarkable, and in contrast to the usual conditions with such wounds. It looked as if the fluid contents of the stomach had passed rapidly into the small gut. The stomachs, to judge by one case, were still full of food.

MECHANISM OF WOUND-PRODUCTION.

There is no difficulty in accounting for the nature of the wounds caused by shell fragments or grenades and bombs, but, in the case of bullets, the injuries seem very extensive compared to the size of the missile. There are some curious cases, two of which have been quoted by Sir Anthony Bowlby in his Bradshaw lecture, in which the gut was injured without the bullet entering the abdomen.

In considering the mechanics of the intestinal lesion, it may be well to clear the ground as much as possible. The gut can undoubtedly be ruptured by a blow on the anterior abdominal wall by a large shell fragment, as it may be by the kick of a horse. Such a case occurred, under the care of Capt. Haycroft, in which the jejunum was ruptured in two places by the impact of shell fuse-cap.

Sir George Makins pointed out, some years ago, that such injuries are probably caused by the gut being caught between the posterior abdominal wall and the oncoming object. Capt. Haycroft's case supports this view, for there was much bruising of the gut in the neighbourhood of the ruptures. In one of the cases quoted by Sir Anthony Bowlby, in which a bullet traversing the pelvis caused a complete rupture of the small gut, this explanation does not seem sufficient. I have seen another case, in which the small intestine was ruptured by a bullet that crossed the rectus muscle, although the inner part of the abdominal wall was intact.

Two cases under Capt. John Fraser may also be quoted. In one, a bullet, crossing the rectus below the umbilicus, was accompanied by a ruptured bladder. In another, a wound

in the iliac region, which was non-penetrating, was found associated with a rupture of a coil of small gut on the mesenteric border, the mesentery itself being infiltrated by blood.

These cases seem to show that a rapidly moving object can disperse some of its energy in a direction at right angles to its flight. If this is the case, what is the opposing object that allows the viscus to be ruptured, instead of being moved away in the direction of the force?

Two cases of splenic injury may also be quoted :—

(1) A man, in whom a shell fragment penetrated the lower left chest, presented symptoms of abdominal injury and hæmorrhage. A cœliotomy showed much blood in the belly and a rupture of the spleen. The shell fragment had failed to penetrate the diaphragm and lay in the pleural cavity.

(2) A soldier presented a horizontal posterior wound, seven inches in extent, in the lower part of the left axilla. The wound gaped, and showed several divided ribs. An exploration revealed a round hole, about one inch in diameter, in the diaphragm, which lay under the centre of the external wound. On enlarging this, the diaphragmatic wound, the spleen presented its outer convex surface. On this was a linear tear about three inches in length, and from this were numerous radiating capsular fissures. This tear might possibly have been caused by the actual passage of the bullet, but the radiating fissures could only have arisen as an indirect effect of the blow given by the projectile. In the case of the ruptured bladder, it is also possible that, being full, the wall could not yield to the force applied and rupture ensued. Another possible explanation is that the blow raised the hydrostatic pressure so suddenly that the bladder burst.

This may be the explanation of the rupture of the intestine, very much in the same way that a blown-up paper bag is burst by a sudden blow of the hand.

It has also been advanced that the so-called turning over movement of the bullet on a transverse axis is responsible for the great damage inflicted. This rotation is apparently likely to occur at the beginning and end of the flight of the projectile. In the first few hundred yards, the base describes a circle the centre of which is the axis of flight. This will render the bullet prone to turn over on a transverse axis, if the point is checked by encountering any object.

At the end of its journey the bullet is again unstable, and so liable to turn a somersault.

If the bullet turns over sufficiently rapidly, it will cut a passage through the tissue which will be as wide as the bullet is long. The complete severance of the gut would be helped under these conditions by the collapsed state, in which state the width of the intestine from the mesenteric to the free border is of less extent than the length of the bullet.

The number of retained bullets in abdominal wounds (68 in 196) would seem to add some support to the view, that an unstable flight was the cause of extensive injuries. On the other hand, there does not seem to be any relation between the size of the entrance and exit wounds, and the amount of intestinal damage which should exist, if the bullet is rotating rapidly enough to cut the intestine completely across.

There is still another way in which complete division may be brought about. When the small intestine is collapsed and the two walls in contact, their combined thickness is little, if at all, greater than the diameter of a bullet. Under such conditions, the bullet, passing parallel to the two walls, would divide both.

TREATMENT.

It is not intended to say much about the actual operative procedure necessary to repair any given lesion, for this naturally follows established practice, but a few special points may be of interest.

In the first place, it was stated in the opening paragraph of this article that the question was now "What cases should be left?" not "What cases should be submitted to operation?" It was also stated that many liver, kidney, and spleen wounds did not require operation, provided there was no excessive hæmorrhage and no doubt as to the involvement of other organs. Bearing this in mind, as well as the general rule "when in doubt operate," there are cases in which any surgeon will still hesitate before taking up the knife. These perplexing cases mostly concern single entry wounds situated on the back, buttocks, thighs, and lower thorax. In such cases, there is no clue to the path taken by the bullet, to its depth of penetration, or, to the damage it may have

inflicted, except the clinical signs.

The most important of these are hæmorrhage, rigidity of abdomen, and a rapid or rising pulse.

Hæmorrhage is itself a sufficient reason for operation, especially if the case is seen early, and the bleeding is presumably continuing; but it must be borne in mind that, though the solid organs bleed readily when first wounded, the hæmorrhage tends to cease spontaneously after a few hours, provided no large vessel has been laid open. Sir George Makins has shown, by post-mortems performed at the base, that very extensive injuries of these organs undergo spontaneous cure, although the kidney and liver are subject to secondary hæmorrhage.

There are, however, many cases presenting single entry wounds in which there are no signs of bleeding, and it is these that perplex the surgeon. Under these conditions, if he does not feel justified in operating on principle, the surgeon must watch the pulse and the rigidity of the abdominal muscles.

As a rule, within four to five hours, the abdomen hardens and the pulse rises above 100, if the intestine has been wounded, though these signs may not declare themselves for a little longer. Sometimes there is only a rapid pulse, sometimes only a rigid belly. In the case of lower thorax wounds, the rigidity of the abdomen must be discounted. One case on which I operated had a single wound in the right axilla at the upper border of the liver, received a few hours previously. The abdomen, rigid to start with, became board-like during the three hours he was watched, and the pulse mounted to 105. There was also much pain. A cœliotomy showed no intra-peritoneal injury, though possibly the extra-peritoneal surface of the liver had been injured. After the operation the man improved, and the rigidity passed away. Eventually, he died of tetanus at the end of a week from the receipt of the wound.

Again, I have seen cases of contusion from large shell fragments exhibit both rapid pulses and rigid abdomens, and yet recover without operation. These cases were left because they had no penetrating wound, and improved directly they were put quietly to bed. In the case of suspicious thigh and buttock wounds, the rigid abdomen and

rapid, rising pulse are to be taken as urgent signals. A few cases when first seen, and in which there can hardly be a doubt that there are extensive intestinal lesions, exhibit a completely flaccid abdomen.

The following is an instance, under the care of Capt. John Fraser, R.A.M.C. The man was shot through the buttock, the bullet emerging below and to the left of the umbilicus. Experience has shown that such wounds are invariably accompanied by grave intestinal lesions. There was much shock, but no signs of fluid in the belly. The pulse was 120. The abdomen was quite soft, although the injury had been received six hours previously. Two hours in bed improved his condition a little. Operation showed three complete divisions of the small gut and an abdomen filled with dark fluid blood. The gut was resected and sutured, and the man left the table in a condition to warrant some hope, but died in a few hours.

It might be advanced that morphia had stopped the hardening of the muscles, but this man had not had an excessive dose, and morphia does not, in my experience, abolish the abdominal rigidity to any appreciable amount.

Capt. Meyer and Taylor have noticed similar cases, and believe that they all die.

A case of rigid abdomen and a slow pulse is quoted under "shock."

Single wounds of the posterior aspect of the flanks present many difficulties. They may involve the colon or have penetrated the abdomen or both. As has been stated, extra-peritoneal colon wounds are dangerous on account of sepsis, and intra-peritoneal ones are almost as bad. To open the abdomen in the mid-line and explore the small gut may lead, if the colon is wounded at the reflexion of the peritoneum, to a dissemination of the infection that is sure to be present but, up to the time of operation, still local. To leave the abdomen unopened is to risk losing the favourable time to repair a small gut lesion. Possibly the best course is a local exploration by a transverse loin incision or a careful watch for abdominal involvement. It is possible that the early operative treatment of abdominal injuries, although it has saved many lives, has increased the deaths due to vertical colon wounds. Makins states that, before the advent of abdominal operation, the wounds of the vertical colon were

nearly the only intestinal lesions that recovered ; they were more favourable, too, than transverse colon wounds.

Under the present conditions, the transverse colon wounds are more favourable than those of other parts. The present exploratory treatment, necessary to eliminate other lesions, does definitely afford a chance of spreading infection from the sides of the belly. Under the old non-operative treatment, vertical colon wounds became shut off, and led to the establishment of a fæcal fistula that eventually closed or was closed.

RECTAL WOUNDS.

Wounds of the rectum can roughly be divided into two classes :—

(A) Those that may be said to complicate wounds of the buttocks, ischial fossæ, or perineum ; and

(B) Those caused by missiles that traverse the pelvic portion of the abdomen. Both are likely to be accompanied by fractures of the pelvic bones.

(A) The missile may be a bullet or a small or large shell fragment ; if the latter, the external damage may be very great, and a large portion of the gluteal region torn away. The sphincter and lower part of the rectum may be completely avulsed, or the lumen opened on one side only. Again, if the projectile is small, the sphincter may be left intact and the lumen of the tube perforated above that muscle. The peritoneum may or may not be opened. The danger mostly to be feared is septic absorption, but, on the whole, the extensive wounds of the buttocks do not do badly at the front, for they are widely open from the nature of the injury.

Treatment.—The treatment of the perforating wounds follows ordinary lines, and consists in providing for drainage by laying open the track or dividing the sphincter (Makins).

If the peritoneum has been opened, something may be possible by cutting off the abdominal cavity by sutures. The question of colotomy must be considered, and its expediency must be determined by the difficulty or otherwise of keeping the patient clean and comfortable. It will mostly be called for in those cases in which the whole lower segment of the bowel has been carried away, and the torn end of the bowel is lying patent in the pelvis. In such cases, the lumen can be closed by sutures or a purse-string ligature,

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which device will, at all events, tend to prevent contamination of the pelvis whilst adhesions are forming.

A transverse colotomy is the operation of choice, both on account (1) of the ease of cleansing the opening and of fitting a belt which will then lie on the natural line of the waist, and (2) of subsequent closure if this is desirable.

(B) Under this heading, it is convenient to include both the rectum proper and the pelvic colon. Both portions are liable to be wounded along with the small gut and bladder. The injury to the former is likely to be severe and multiple, though, in a few cases, it escapes altogether. The lesion of the small gut must be dealt with in the ordinary way, and, if not too extensive and if no large amount of blood has been lost, is less to be feared than the rectal injury itself.

The rectum proper may be wounded extra- or intra-peritoneally or both. The missiles that cause such injuries take a transverse, antero-posterior or semi-vertical (the well-known "buttock wound") direction. If transverse, the entrance and exit wounds lie to the posterior aspect of the buttocks, and whether it catches the extra- or intra-peritoneal surface or both will depend on the transverse plane traversed, and the obliquity of this plane to the transverse plane of the body. The transverse wounds are very deceptive, leading one to think from their posterior situation that they have escaped the bowel.

Treatment.—There will not be, as a rule, much doubt that an exploratory cœliotomy is the correct procedure, but if there is, it is well to err on the side of operation. I refer more particularly to the transverse and semi-vertical buttock wounds, which have acquired an unenviable reputation in this war. If the peritoneal surface has escaped, the abdomen can be closed and the wound opened up from the exterior. The wounds of the pelvic loop may be small in size, so that suture meets the case. On the other hand, the destruction may be so great that an iliac artificial anus must be deemed the wisest course. Whether an extensive wound should be repaired must depend on the condition of the patient, and this is not likely to be good if a lesion of the small gut has already been dealt with.

Intra-peritoneal wounds of the rectum proper can often be sutured, though, from their depth in the pelvis, great

difficulty may be experienced, and the Trendelenberg position found necessary. A drain down to the lesion is a wise precaution in all cases, and the question of a colotomy must be determined by the probability or the reverse of the suture holding; it is perhaps to be recommended in most cases, except when a supra-pubic bladder drainage has been necessary. Whether a colotomy is indicated in the case of an extra-peritoneal wound must be determined by the size of that wound, and by the efficiency of drainage provided opening up the wound.

In conclusion, it can be said that a fatal result from septic peritonitis is much to be feared, although the lesion is small, and the patient in good condition at the time of operation. The infectivity of the lower bowel contents is well known and much feared by the rectal surgeon. Fortunately, among 73 cases of great gut injury, there were only six cases of injury to the rectum proper, but only two of these were sent to the base. There were, in addition, nine cases of injury to the pelvic colon, that were treated by suture, and of those five died.

CASES OF FAILURE OF SURGICAL TREATMENT.

Difficulties of Collection and Evacuation.—In the first place, there is the delay in getting the wounded man to hospital. At the present time, the rapidity with which the transportation is accomplished is a matter for much congratulation, and one must speak with enthusiasm of the work of the regimental officer, the field ambulances, and the administrative branch in this matter. In one favourably placed unit, the average period between receipt of wound and arrival in hospital was four hours. The shortest period was one hour; the longest was eight hours. The average time in cases that recovered was a little under three hours; that of the cases that died was rather over four and a half hours.

Of course, the time spent between the firing line and the hospital varies in different sectors of the line, and is dependent on two main factors:—

- (1) Difficulty of collection.
- (2) Difficulty of transportation.

(1) It may not be possible to reach the men who may

which device will, at all events, tend to prevent contamination of the pelvis whilst adhesions are forming.

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and one must feel thankful if they die, before one is called upon to decide as to the advisability of operation. One feels bound, though reluctantly, to give them the chance of an abdominal operation, and one or two have gone to the base; others have died of septic meningitis.

Shock has been dealt with in a preceding section.

Hæmorrhage.—Putting the above-mentioned cases aside, hæmorrhage stands out as the greatest enemy of the surgeon. It is principally on account of hæmorrhage that rapid transit is so necessary and successful, and the reason that risks must be run in moving a shocked man.

Hæmorrhage comes from all sorts of places:—

- (1) Stomach-wall vessels.
- (2) Omentum.
- (3) Mesentery of the small or large intestine.
- (4) Retro-peritoneal tissue.
- (5) Abdominal wall.
- (6) Abdominal veins.
- (7) Liver.
- (8) Kidney and spleen, and especially their vessels.

(1) The walls of the large and small intestine do not bleed to any appreciable amount, but the vessels running on the stomach wall do cause very great hæmorrhage.

(2, 3) The omentum and the mesentery of the small gut are sources of severe bleeding, even without any intestinal lesions.

(4) Hæmorrhage into the retro-peritoneal tissue is a source of great trouble, and often raises the posterior abdominal peritoneum so as to touch the anterior abdominal wall. When the abdomen is opened, it may look like a large purple intra-abdominal tumour. The surface shows cracks, through which slowly oozes blood. If left, it may become infected with gas gangrene; if, on the other hand, any attempt is made to find the bleeding point, the difficulty may be very great, even if the surgeon is successful. Whether this attempt is made must depend on the situation of the hæmatoma and the likelihood of injury to big vessels; most probably, the best thing is to leave it alone. There is often very considerable shock, which is out of proportion to the

lie out in the "no man's land," or, in confused fighting in a maze of trenches, he may not at once be found.

(2) When he has been got into the regimental aid-post, there is still the communication trench to be traversed. Even in fine weather, it may take a sound man an hour or more to walk along this, and it can well be imagined what time will be consumed by a stretcher-party when the trench is deep in mud and water. Sometimes this work is so arduous, that one complete tour down and up is all that a stretcher bearer can compass without rest.

Some communication trenches have mechanical appliances for carrying heavy weights, and these are used for the transport of the wounded. In other places, there are light railways on the ground level, but these can only be used at night or on special occasions.

When the wounded man has been got out of the trenches, it may be impossible to move him from the advanced dressing-station to the hospital on account of the roads being under observation and shell fire.

It will be seen that, as a rule, the greater part of the time taken in getting a man to hospital is spent in the trenches and very little on the roads, once in an ambulance, running at a maximum rate of fifteen miles to the hour, a mile or two further adds very little to the time lost, and one has only to consider, for the most part, the bad effects of jolting.

Another point, that must be taken into consideration in placing a hospital, is the bad effect of exploding shells on patients, even though they are in no actual danger. A man who will pay little attention to such matters when hale and hearty, will be very much affected by them when lying wounded and passive in his bed.

OBSTACLES TO RECOVERY WHEN IN HOSPITAL.

First of all, there are extensive abdominal injuries which are fatal from their very extent. Secondly, there are cases of abdominal wounds complicated by other injuries, such as fractures of femur and skull, and avulsion of limbs. Some of these are saved, but many die; some are so bad, that no operation is justifiable. The most pathetic of all are men shot through the belly and spinal cord. There are not many,

formed of its efficacy.

SEPTIC ABSORPTION.

This takes place from four places—

- (1) Peritoneum.
- (2) Retro-peritoneal tissue.
- (3) The wound.
- (4) Operation site.

(1) *Peritoneum*.—Makins has pointed out that there is a difference between large and small gut infections. The latter tends to spread progressively; the former, if undisturbed, to localize itself. This, taken with their lateral position, is one of the reasons why many cases of the wounds of the vertical colon reached the base, before operation became the established practice. On the other hand, the infection from the great gut is more virulent, and, if carried into the general peritoneal cavity by surgical manipulation, is likely to be rapidly fatal. The results of suture of the colon, especially of the pelvic portion, are very disappointing. The difference between the two portions of the bowel is well known in civilian practice.

As regards the small gut, there does not seem to be much danger of infection in the first few hours, but a critical period would appear to be eight to twelve hours. (The limit of recovery up to now is twenty-four hours.) The infection is not usually brought about by the extrusion of the bowel contents, for the viscus is generally empty and paralysed, but it must be attributed to the carrying out of infection by the projectile and to infection of the peritoneum by the everted mucous membrane. It seems likely that bleeding, especially if near the wound in the bowel, may add to the gravity of the situation by carrying infection to distal parts of the abdomen. Lieut. Sampson tells me that he has had the blood tested bacteriologically in two cases, and that it was swarming with streptococci.

Again, the projectile may itself carry infective material into the belly as it does into the limbs. The peritoneum is immune to the *ærogenes bacillus*, but not to the streptococcus.

The amount of peritonitis is, to some degree, dependent on the length of time that has elapsed since the receipt of

blood lost to the circulation. The sources of the bleeding are the local vessels, or even the vena cava, renal vessels, or pelvic veins.

(5) The deep epigastric artery is the usual source.

(6) In wounds of the lower abdomen, the pelvic veins are not infrequently found injured. The abdominal vena cava has been found injured on several occasions, and has been closed by sutures (Lieut. Sampson), though unsuccessfully; on one occasion, the rent has been successfully brought together (Capt. Taylor). The renal veins, again, have been found torn and closed, after nephrotomy, by ligature, and the same may be said of the renal and splenic artery. With these last exceptions there has been, as far as I know, no large artery found wounded at operation.

(7, 8, 9) The parenchyma of all these organs bleeds at first but it is probable that, if no large vessels, including veins in the liver substance are opened, the hæmorrhage ceases spontaneously.

The amount of blood lost must be judged by the pallor and pulse. Percussion is very fallacious, although the blood is nearly always fluid, nor are the other classical signs of hæmorrhage present, such as restlessness and air-hunger. Knowing that hæmorrhage is present, the operation should not be unduly delayed, but, in spite of this, a period of rest in bed, warmth, and the administration of fluid by the mouth, subcutaneously, by the rectum, or intravenously, as the nature of the case seems to demand, is apparently the best course.

It must be remembered that the hæmorrhage is likely to begin afresh or be greatly accelerated, directly the abdomen is opened; therefore, a large incision is to be recommended as greatly facilitating the finding of the bleeding point. The cavity should be cleaned as perfectly as possible, for experience has shown that, even without an intestinal lesion, the blood may become infected and cause trouble after transference to the base.

Many cases which leave the operation table in fair condition succumb in a few hours, apparently from the effects of loss of blood. A repetition of saline infusion is powerless, in many cases, to prevent a fatal termination; transfusion of blood and of citrated blood has been tried, but the number of cases is as yet too few to allow an estimate to be

formed of its efficacy.

SEPTIC ABSORPTION.

This takes place from four places—

- (1) Peritoneum.
- (2) Retro-peritoneal tissue.
- (3) The wound.
- (4) Operation site.

(1) *Peritoneum*.—Makins has pointed out that there is a difference between large and small gut infections. The latter tends to spread progressively; the former, if undisturbed, to localize itself. This, taken with their lateral position, is one of the reasons why many cases of the wounds of the vertical colon reached the base, before operation became the established practice. On the other hand, the infection from the great gut is more virulent, and, if carried into the general peritoneal cavity by surgical manipulation, is likely to be rapidly fatal. The results of suture of the colon especially of the pelvic portion, are very disappointing. The difference between the two portions of the bowel is well known in civilian practice.

As regards the small gut, there does not seem to be much danger of infection in the first few hours, but a critical period would appear to be eight to twelve hours. (The limit of recovery up to now is twenty-four hours.) The infection is not usually brought about by the extrusion of the bowel contents, for the viscus is generally empty and contracted; it must be attributed to the carrying out of infection by the projectile and to infection of the peritoneum by the exposed mucous membrane. It seems likely that bleeding, especially if near the wound in the bowel, may add to the gravity of the situation by carrying infection to distant parts of the abdomen. Lieut. Sampson tells me that he has had the bowel tested bacteriologically in two cases, and that it was infected with streptococci.

Again, the projectile may itself carry infection, and enter into the belly as it does into the lungs. The peritoneum is immune to the *ærogenes bacillus*, but not to the *staphylococcus*.

The amount of peritonitis is, to some degree, dependent on the length of time that has elapsed since the wound.

the wound, but it varies within wide limits, as judged by the amount of lymph present. After five to six hours, there may be no sign of infection; at other times, it will be well marked.

No great stress can be laid on the amount of exudate as a guide to prognosis; a better test is the distension of the bowel. It is possible that a wound of the ileum is more dangerous than that of the jejunum. The infectivity of the stomach is supposed to be less than that of the small intestine, but perhaps not to the extent that one would imagine from the experience of civil practice.

There is nothing peculiar about the peritonitis seen after abdominal wounds, but there are some points to which it is worth referring in their bearing on treatment.

In some cases, usually rectal, the fatal result comes within 24 hours; in others, it may be delayed for 10 days or so. The first may be called fulminating, the second the dormant form. The usual period of death is from the third to the fifth day. It is interesting to note that, in the pre-operative days, cases survived long enough, and did well enough, to be sent to the base.

If a patient is going to die of peritonitis, suture of the lesion will only hasten matters by increasing shock and diffusing the infection. The state of the peritonitis at the time of operation must be such that recovery is possible. This is exactly what is seen in cases of acute peritonitis in civil practice. If the patient is in good condition at the time of operation, the abdomen can be closed up with certain hope that a good result will follow, no matter what the apparent condition of the peritoneum may be.

Putting aside those patients who do well from the first, and those who never look like recovering, the post-operative cases can be roughly divided into three classes:—

- (1) Those that do well for 36 hours or so and then go through a critical period, with abdominal distension, vomiting, and a rising pulse.
- (2) Those that are troubled by sickness continuing from the operation, but in whom the sickness diminishes and the pulse rate falls.
- (3) Those who vary in an astonishing manner from day

to day, so that one can have no certainty of the ultimate result. This condition is often independent of the condition of the bowels, which may be acting.

These are the cases that Sampson Handley has described in his interesting paper (*Lancet*, April 8, 1916), and his suggestions must have a trial. The difficulty is in choosing the right moment to interfere. From the description given above, it will be seen to be difficult.

It would also be of interest to determine what is the essential cause of peritonitic vomiting. Is it always really obstructive? Short-circuiting the re-section site and the formation of a jejunostomy have been tried at the time of the first operation, but I do not know that the results are encouraging. Even in pure obstruction they may fail, as will be pointed out later, and in peritonitis they seem from the nature of the condition to be of little use.

If short-circuiting is to be successful, the method advocated by Sampson Handley seems to be the method of choice. It may be perhaps better that the short-circuiting between colon and jejunum should be done at the first operation if much distension is present; the cæcum can be subsequently opened if necessary.

For the short-circuiting to be successful, the stomach and upper part of the jejunum must be in good condition. In a certain number of cases the stomach and upper intestine become dilated before the lower; there seems to be a nervous as well as a septic factor in this.

(2) *Retro-Peritoneal Tissue*.—There are two forms of infection: (1) Gaseous and (2) non-gaseous.

It may occur with or without a wound of the bowel, in which latter case the infection must have travelled in with the missile. The colon is usually the bowel implicated in these cases, and that on its retro-peritoneal surface. The entrance wound is on the flank or loin. Very often the infection is one of extreme virulence, though there may be little or no external signs. The pulse is weak and rapid, and the surface cold and clammy, and death may ensue within twelve hours or so from the time of wounding.

At another time the onset is less sudden, and the patient

the wound, but it varies within wide limits, as judged by the amount of lymph present. After five to six hours, there may be no sign of infection; at other times, it will be well marked.

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those considered above.

The reason for the inert condition of the lower segment of the bowel after a resection is not altogether obvious. After receipt of injury, the small bowel on both sides of the trauma becomes, for a time, paralysed or, at any rate, inactive. This is shown by the state of the bowel at operation, by the non-expulsion of its contents, and by the fact that, for some considerable time, the injured bowel remains in the place where it was hit. A resection is performed, and some additional trauma inflicted on the viscus. After a variable period, the bowel recovers its tone. It is permissible, I think, to believe that parts furthest from the lesion recover first. This is suggested by the fact that a lateral anastomosis, which short-circuited the trauma, has led to a restoration of the intestinal current, the lower as well as the upper part of the intestine fulfilling its function.

After the operation, the lower bowel has no inducement to resume its normal function, but the upper segment will be stimulated by the entrance of food and fluids. The upper segment will recover first, and pass its contents on to the next segment, which will, in turn, resume its function, and so on until the injured portion is reached. Why, in some cases, does the next segment fail to act? The fault lies in the immediate neighbourhood of the lesion, for, in one case, a lateral anastomosis was followed by recovery. The explanation is either that the traumatic paralysis is still present, or that the section of the bowel has interfered with Auerbach's plexus, and so prevented the onward passage of the peristaltic wave. In one case, the short-circuiting failed to cure the block, and the bowel dilated down to the anastomotic opening. It is possible that, in this case, the opening was made too close to the lesion and in a part of the gut still paralysed.

In the light of this failure, it would seem that the best procedure would be to make the lateral anastomosis at a good distance from the original lesion, especially in the lower segment or, possibly still better, into the transverse colon, provided that the injury was not at the top limit of the jejunum.



appears to do well for a time. Then the pulse and temperature begin to rise, and the patient becomes ill. Sometimes a fæcal fistula forms, and the patient becomes better, or the same result follows a laying open of the wound. At another time, the skin becomes bronzed and crepitant, and the man dies rapidly in spite of incisions.

The gas infection, when no viscus is wounded, may declare itself in a different way. As a rule, the wound is a small one in the loin, and apparently has not involved a hollow viscus. Then the pulse rises, the belly becomes hard and distended, and the aspect suggests peritonitis. The abdomen is opened, and the peritoneum is found pushed forward, as was described in the case of retro-peritoneal hæmorrhage. This tumour crepitates on pressure, but no lesion can be found in the bowel. Such cases are almost uniformly fatal.

(3) *The Wound*.—This, on the anterior surface of the abdomen, and unconnected directly with any intestinal tissue and after-excision, may show signs of virulent sepsis and gas infection, although the intestinal lesion in the small gut has been successfully dealt with.

(4) *Operation Site*.—The operation site, too, becomes badly infected in a large number of cases. The origin of acute infection is the peritoneal cavity, and is most likely to be met with when that cavity is full of blood, which is known to be grossly contaminated. This is very much the same as is seen in cases of diffuse appendix peritonitis, when the peritoneum deals easily with the remaining infection after the removal of the appendix, but the wound falls an easy prey to the bacteria. The wound may suppurate violently, fail to unite, and expose the intestines, or it may slough over a wide area, while the intestinal lesion causes no trouble.

PARALYSIS OF THE BOWEL UNCONNECTED WITH PERITONITIS.

In two cases, which will shortly be reported by Capt. Owen Richards and Capt. John Nasen, there was a block at the re-section site due, not to peritonitis, but to paralysis of the lower segment of the bowel. One case was successfully treated by a short circuit, but a similar operation failed to cure the other. It must be noted that this condition is not due to sepsis, and forms quite a different category to

degrees of trauma, are interesting in connection with the work of Legg² of Boston, who returns to the subject of what he calls

OSTEOCHONDRAL TROPHOPATHY OF THE HIP-JOINT.

This affection has been studied by Perthes, Sourdât, Waldenstroem and others, under different names. The great importance of the work is in respect of its attempt to separate a class of cases from amongst those ordinarily treated as early tuberculous arthritis, and condemned unnecessarily to prolonged immobilization and rest. The cases are those of children, generally from five to eight, or perhaps three to twelve, years old, who, after some slight trauma, exhibit a decided and persistent limp, but with no pain, no constitutional symptoms, and but little if any spasm or shortening. He makes his diagnosis upon X-ray appearances; a flattening of the epiphysis, a thickening of the femoral neck, and an increase in the radiographic space between the head of the bone and the acetabulum. His figures are well worthy of study. He attributes the alterations in the bone and cartilage to disturbance of the blood-supply of the epiphysis, supporting his contentions by demonstration of the distribution of the vessels and the possibility of such disturbance by slight injury. He notes the occasional occurrence of those deformities of the upper end of the femur, that are ordinarily associated with the clinical condition coxa vara.

Stress is laid upon the fact that the joint-cartilage is not affected, for there is no limitation of flexion and no grating as in juvenile arthritis deformans, and upon the fortunate circumstance that there is a persistent tendency to spontaneous recovery. Allison and Moody,³ who study this, or a closely analogous condition, under the title of

OSTEOCHONDRITIS DEFORMANS JUVENALIS,

also come to the conclusion that there is an underlying disturbance of the line of epiphysial growth, due to circulatory changes, but their experimental work, so far, has proved negative.

OBSTETRICAL PALSY.

Turner Thomas, of Philadelphia,⁴ has suggested the

RECENT WORK IN ORTHOPÆDICS.

By E. ROCK CARLING, M.B., F.R.C.S.

Surgeon, (in charge of Out-patients) Westminster Hospital; Surgeon, Seamen's Hospital; Consulting Surgeon, Chislehurst and Cray Valley Hospital, etc.

COXA VARA.

PUTZU,¹ in relating a case of traumatic coxa vara in an adult, gives a lengthy review of the whole subject, and formulates the following conclusions.

Ordinarily, coxa vara of infancy and adolescence is of traumatic origin, not necessarily associated with separation of the epiphysis or fracture of the femoral neck. He admits that some of the X-ray appearances of the parts, alleged to be indications of slight degrees of trauma, cannot be differentiated from those to be observed by X-rays of his second class, essential, static, or idiopathic, due to a "diminution of resistance" or softening of the epiphysial cartilage, through which, beneath the action of the body-weight and fatigue, the femoral neck bends, and the head of the bone "slides" downwards. In this latter form trauma, if alleged, is usually trivial, or occurs after the first appearance of symptoms, and may, indeed, be a result and not a cause of the condition.

Whilst radiographs do not permit of distinction between these two classes, they make it possible to exclude the congenital, rachitic, osteomalacic, and inflammatory types.

He considers that all cases due to recent trauma, and those not yet thoroughly established, should be treated by forcible rectification under narcosis, followed by immobilization in mid-abduction and internal rotation, with adequate extension (Whitman). Myorrhesis should be abandoned, and tenotomy of the abductors used but rarely. For inveterate cases, he advocates subtrochanteric osteotomy, but says that the hinge operation of Codivilla gives excellent results in the hands of those skilful and experienced enough to perform it properly.

Putzu's account of his findings, in connection with slight

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OBSTETRICAL PALSY.

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possibility of subluxation of the humerus, with laceration of the joint capsule and effusion, as the initial cause of birth palsy; he insists on the importance of observing the possibility at birth. Sever,⁵ criticizing his view, points out that in some cases, there is no subluxation; that congenital dislocation is not accompanied by paralysis, although separation, or fracture, of the epiphysis may be the cause of a secondary palsy; thirdly, he points to the constancy of types revealed by careful muscular analysis. It is true that, in the presence of a birth palsy, there may be a subsequent posterior subluxation.

ANALYSIS OF MUSCLE-GROUP PALSIES.

On this question, Lovett⁶ makes a valuable contribution in reference to the treatment of infantile palsy. He has devised a "test," by means of a spring balance and sling, which has enabled him to detect a much wider distribution of muscular affection than is revealed by the electrical test usually employed, though not wider, perhaps, than present views as to pathogeny, has led pediatricists to expect, and to find by clinical observation. Lovett has tabulated standard positions of the limbs during the performance of tests of all movements and muscle groups, and has made thirteen thousand observations on 177 patients. He emphasizes the enormous preponderance of partial palsies of individual muscles; the predilection of the leg muscles for total paralysis; the detrimental effect of over-fatigue by exercises, or heavy and prolonged massage; and the importance of "spacing" the exercising of very weak muscles. When the whole musculature is submitted to the delicate test he has devised, it is found that the so-called "abortive" cases disappear; in some region, defective power will be discovered, even if it do not amount to palsy. Lovett has found his test of great value in checking treatment; it has led him to discriminate in favour of *education* of movements, muscle *training*, rather than routine massage and resisted movements.

CLUB-FOOT.

[[Bargellini, of Milan,⁷ writing on the subject of *Pes cavus* associated with *spina bifida occulta*, and reporting two cases, notes especially their progressive character about the age of

puberty. He considers the deformity to be the result of a spastic syndrome, limited to the musculature of the leg and foot, and dependent on a congenital anomaly of the cord. Although he notes that both his cases had hydrocephalus, he, apparently, attaches no importance to that factor.

Fiske, of Boston,⁸ defends the somewhat trite thesis, that cases of congenital club-foot, treated by non-operative methods, do better in the end than those for which cold steel is used. He admits the factors of age, rigidity of foot, and past neglect, but says, truly enough, that they are beyond control, whilst the method of treatment selected is not. All structures and tissues of the foot share in the deformity, and treatment that is "localized" in any way, *e.g.*, to the fibrous structures, as in tenotomies, is not productive of uniformly satisfactory results, whilst "destruction" of any tissue prevents the restoration of natural shape, strength and balance of the foot, and is prejudicial to the return of normal function. He considers that non-operative methods, by which he means repeated manipulations, followed by plaster, and, later, metal retentive appliances, have the advantage of any measures involving a knife-point or blade, in utilizing the plasticity and growth of the foot. He finds, as do the misguided people who take short cuts, that absolute over-correction of the foot, and unrelenting attention to the maintenance of this position are essential. In his hands, at any rate, taking all varieties and degrees of case, it is two to one in favour of manipulation alone, as against open or subcutaneous operation for a perfect prognosis.

It is, perhaps, rather a point in Fiske's favour, that when the other side of the picture is presented, as it is in an article by Marshall and Osgood,⁹ on the late results of operations for correction of foot deformities resulting from poliomyelitis, the authors claim, very modestly, only 88 per cent. of "improvement." Of 26 cases given in detail, only four are represented as excellent in result, and ten, good. Seven cases of astragalectomy resulted in useful, very stable feet in four cases, slight instability in two, and serious instability in one instance. Of arthrodeses of the ankle-joint, there were three useful ankles in good position, one stable and useful, with a few degrees of motion, and two relapses, in one of which a subsequent astragalectomy was successful. The tendon

lengthenings, strengthenings, and transplantations gave fair results, and never resulted in over-correction, the final condition usually being one of partial attainment of the desired effect.

MULTIPLE ENCHONDROMATA.

Several authors have recently written upon this subject, contributing a number of new cases, and, incidentally, proving the condition to be less rare than might have been supposed, but adding little to existing knowledge. Marshall¹⁰ is content to say that the findings in his case are consistent with the theory of Ehrenfried, as given by Ashhurst,¹¹ whilst Perrin¹² exhibits true Gallic address in avoiding the difficulty by a quotation of Lenormant's neat conclusion that, *pace* Bessel-Hagen, and Volkmann, "the disturbances of growth and the exostoses are two different manifestations, habitually associated and evolving on parallel lines, but the co-existence of which is not absolutely inevitable, and which are not cause and effect." Perhaps it is not an equally good example of Gallic lucidity. In fact, there is yet no knowing whether the cause be microbic or toxic, or due to depraved internal secretions, and if it be "ricketty," whether that may not be another way of saying one of these same three things.

TORTICOLLIS.

FitzSimmons,¹³ reporting a hundred cases of torticollis, of all types, gives a general review of the subject, and speaks of his results in operating for the congenital form, as being satisfactory to the point of "cure" in 64 per cent. Although he only speaks of three cases in which he divided the sternomastoid at the upper end, he commends the operation as easy, and as giving no scar, or one easily hidden.

OPERATIONS.

Meisenbach¹⁴ describes an operation for the rigid type of painful anterior arch of the foot, associated with callosities beneath the heads of the second, third, and fourth metatarsal heads. The proximal phalanges of the toes are dorsiflexed, and the outstanding symptom is burning pain. For such a case, complete relief is afforded by osteotomy of the three metatarsals, three cm. from the metatarso-phalangeal joints,

of sugar or starch. That the liability to catarrhal infection is greater seems to be supported by all clinical evidence. Lastly, it is generally believed that the tendency to rickets is greatly increased. A diet with such formidable drawbacks must only be used as a temporary expedient in order to obtain, for the time being, a remission of the vomiting and other symptoms of indigestion, and to control a dangerous loss of weight from dehydration. We must do all in our power to counteract the claims of the proprietors, that carbohydrate foods should permanently supersede the ordinary standard substitute diet of cow's milk.

It is in early infancy that the part played by faults of environment is most striking. Efficient ventilation, cleanliness, and the provision of warm but porous clothing, equally distributed over the child's body, are essential, if infection is to be avoided. The danger of contact infections should be explained to the mother and nurse. The baby should be kept out of rooms crowded with adults. Kissing and close contact of face with face should be avoided. If the mother or nurse has a sore throat or a cold, she should realize the grave danger to the child. Carious teeth with pyorrhœa alveolaris in mother or nurse may be responsible for much infantile infection. I have seen an alveolar abscess in a nurse give rise to an acute septic sore throat in a child of a year old. A case of active tuberculosis in the environment of a young child is an extreme danger. If the mother is infected, she must resign herself to separation from the child.

Faults of hygiene, which are relatively harmless for adults, are of the most serious import for young children, and in every case of unexplained continued ill-health in an infant, we must explore the whole environment with a view to their detection.

(b) OLDER CHILDREN.

When the child learns to walk well, the environment in the home loses something of its supreme importance. The child, who can spend long days out of doors, is less dependent upon the conditions of the home. Nevertheless, the ill-effects of faults of hygiene still remain evident, especially in winter when outings are few, and in times of illness when the child may again be wholly confined to the house. On the other

The chart is divided into five numbered parts. In each the caloric value of the food was approximately the same. In the first, the diet was whole citrated milk. In the

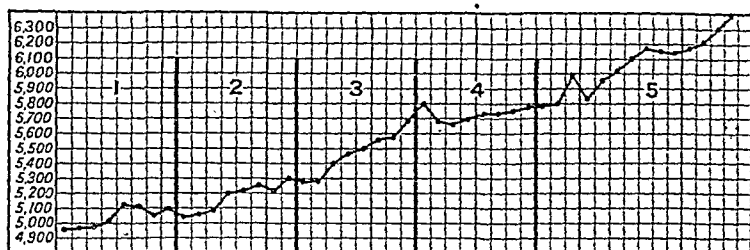


Chart I.

second, the fat was reduced from 4.2 per cent. to about 2 per cent.; that the weight immediately began to rise suggests that the digestion of fat was here especially at fault. In the third period, a considerable amount of malted flour was added to the fat-low milk; the weight rose more steeply. In the fourth, an attempt was made to return to the standard diet of whole citrated milk, but the weight curve flattened, and the child vomited and passed fatty stools which were sometimes green. In the fifth period, the same diet as in the third—a high percentage of malted flour and a low percentage of fat—was restored, and the weight again rose rapidly. It was not until many weeks later that this wasted and atrophic child regained the power of thriving upon a diet of whole citrated milk.

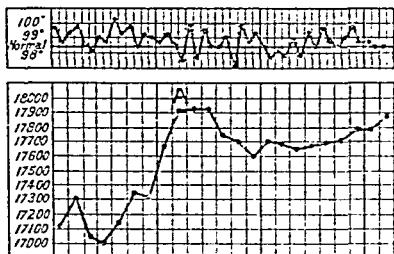
The chart is useful as showing the good which may be done at times in severe cases of chronic infection, with profound wasting and dehydration of the body, by feeding with malted flour made according to Liebig's prescription. It may serve as well to emphasize that the child must not be taken to have recovered, just because the weight curve shows an improved retention of water in the water depôts of the body. We must first prove that the child has regained the power of thriving upon a diet of whole citrated milk, or some other diet with sufficient fat.

The disadvantages of a diet too poor in fat and too rich in sugar are well known. There is an increased risk of fermentative diarrhoea, the direct result of the faulty digestion

to the weight curve, and to the visible effect upon the catarrhal processes and the secondary glandular enlargement. I will quote only two examples from my notes, as briefly as possible.

V. S., æt. 6, a fat but undersized girl, had attended the Ophthalmic Department of Guy's Hospital for three years for chronic conjunctivitis and corneal ulceration. She had had repeated attacks of bronchitis from the age of two years; at three years she had persistent diarrhoea. The constant lachrymation from the conjunctival catarrh had set up a very extensive dermatitis, which had spread over the cheeks and the forehead. The upper lip was reddened and inflamed from chronic nasal catarrh. The tonsils and adenoid

Chart V.—*Starch-fed child showing the effect of a change of diet.*



A fat, watery child, aged 4, who had been fed upon bread in huge amounts. During the observation, till the day marked A, he was given one pint of milk and as much bread as he would take. For the first few days he was homesick and would not eat, but later, took on an

average, 19 ounces of bread daily. At A he was given a diet of milk, meat, fish, green vegetables and fruit juice.

Note 1.—The unstable temperature.

2. The rapid rise in weight while bread was taken freely, due to retention of water.

3. After the change of diet at A, the initial fall in weight—due to excretion of fluid from the water depôts—followed by the gradual steady rise, which indicates actual growth.

This child had had broncho-pneumonia on three occasions, and was seldom free from bronchitis.

vegetations were very large. Many cervical glands were palpable. the abdomen was very prominent, and there was a small umbilical hernia. There was no evidence of tuberculosis. The mother said the child ate enormously. On several days she ate 18 ounces of bread, and this was afterwards verified in hospital. She refused meat and vegetables except potatoes. She drank no milk. She was fond of suet puddings, cakes, and sweets. Upon a diet of meat, fish, eggs, green vegetables, fruit, milk puddings, with bread restricted to 3 ounces daily, she made remarkable improvement. In six months in her own home, she grew 3 inches and gained 5 lbs. in weight. The nasal and conjunctival catarrh disappeared, together with the infiltration of the skin of cheeks and upper lip. The abdomen was less prominent and the umbilical hernia disappeared. The child had improved remarkably both in vigour and

on which I lay stress.

The greatest service which we can do to children such as these is to give them a diet which, while it contains a sufficiency of protein and fat, is by no means a generous diet, and does no more than cover the actual physiological needs for food. The aim must be to dehydrate the body and to replace the fictitious increase in weight, due to water retention, by a true growth. Carbohydrates and salts are, therefore, especially diminished. If we are successful in this, I believe that the tendency to catarrhal infection will usually disappear rapidly. I have notes of many children in whom persistent catarrhs,

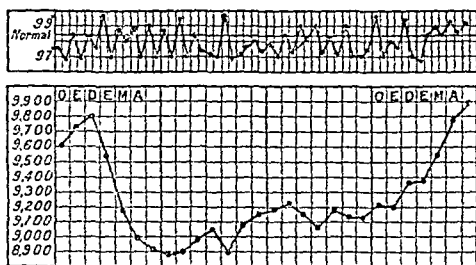


Chart IV.—*Starved child with actual œdema on the dorsum of hands and feet.*

Similar curves of an unhealthy child aged 2, who had been fed almost entirely on bread, potatoes, biscuits, cake, and sweets. According to his mother "he eat as much bread as his

father" and was "constantly eating sweets." For the first three weeks after admission, a milk diet only was given. In the last week bread in large quantities was allowed. The œdema, which disappeared after six days, reappeared with the sudden rise in weight following the intake of bread.

Note 1.—The unstable temperature.

2. The rapid fall in weight from the excretion of fluid. The fall in four days amounted to 28 ounces, equal to one tenth of the body weight.

3. The genuine gain of weight upon a milk diet, following the sudden fall.

4. The fictitious rise due to retention of water after the change of diet in the last week.

which had resisted continued local treatment, disappeared within a few months after the faults of diet had been corrected. I have given such children meat, fish, eggs, green vegetables, cereal foods in moderation, stewed and fresh fruit. I have limited bread strictly, and have omitted sugar, sweets, biscuits, cakes, soups and all dishes containing excess of salt. Milk may be given up to one pint daily, but in some cases I have removed a considerable part of the fat. No general rule can be given, but the diet should not be generous, and in the case of a very fat child there should even be some mild under-feeding. The diet in each case must be regulated with regard

coming under my care, for, besides treatment by electrolysis, I only use vaccine for rheumatic cases, and a little sandalwood oil may be taken after the discharge has become slight.

In reviewing this work, I have classified the cases into acute and chronic according to the duration of the discharge.

At the Male Lock Hospital, I am provided with cases of acute gonorrhœa, in which the discharge has existed for not more than 14 days, and cases of longer duration which I place in the second group. It is quite an artificial distinction, but a line has to be drawn somewhere.

This series is composed of 69 acute and 31 chronic cases. The average number of treatments required in the acute cases was 16 (minimum=5 and maximum=34). In the chronic cases the average number of treatments necessary was 20 (minimum=14 and maximum=35), the duration of the disease in this group being from 14 days to five years before commencing electrolysis.

Subjoined I append particulars of the shortest and longest cases in each group.

ACUTE CASES.

CASE 1.—(Shortest treatment.) Mr. F——, 34, second attack. Discharge reported two weeks. This man had a free-flowing discharge containing gonococci. Smarting and scalding were severe, but these disappeared after two treatments, and he recovered after five administrations. After recovery, he admitted to other out-patients that his discharge had existed about three weeks, but he wanted to get the electrical treatment, and therefore declared himself as a 14-day case.

CASE 2.—(Longest treatment.) Captain ———, 30, discharge for two days, found gonococci present. Patient had a sanious discharge from the outset with hæmorrhage at the end of each micturition, and this decided me to abstain from electrolysis for three days until it subsided. There was little pain and no frequency. Progress was slow, and although the discharge was very slight after ten treatments, it was clear that the deep urethra was involved. This was systematically treated by deep urethral electrolysis, and the gonococci and suppuration were overcome by giving a current as large as from 4 to 5 milliamperes for twenty minutes at a time, the current being reversed every five minutes. In so severe a case it was very satisfactory to find that no complications arose, and fortunately this patient found alcoholic abstinence no effort.

The above are the best and worst of the (14-day) acute cases, and it is noteworthy that this second case required as many

DRUG PROGRESS.

By D. M. MACDONALD, M.D., F.R.C.P.E.

Arnside, Westmorland.

A TERSE and complete definition of drug progress is difficult to supply, the term being so gloriously comprehensive. Take the word "drug." In a restricted sense, it might imply a simple medicine, but in an extended form, any substance employed in the cure of disease. The only precise definition of the term, or of its sphere would be a physiological one, and such a classification is at present unattainable. By what process, then, may the above title be defined, and by what standard may it be measured?

Drug progress might indicate recent introductions to the British Pharmacopœia, or hurried departures from it following a long or short tenure. It might include the discovery in the crucible of an element or metal, which ultimately occupies an important place in the realm of therapeutics. It might apply to improved methods in pharmacy, such as the standardization of preparations like tincture of digitalis, nux vomica, or belladonna, etc. It might cover recent and important additions to the already mighty host of synthetic remedies and coal-tar derivatives, as well as the rapidly increasing number of products from glands, ductless and otherwise.

The practical point is to enquire into the relationship between drug progress under some of those headings and the average general practitioner, as to what knowledge the latter has of the former, and how this is acquired. In this connection, the suggestion might be offered that new drugs should be introduced into practice and vouched for by some accepted authority, and not by the present haphazard method of experiment and advertisement. A useful feature of a medical paper might then particularize the value of a new drug or a new use for an old one, and so discourage some abuse caused by a too hasty adoption of drugs, the term

of usefulness of which is often quite short.

The root of the trouble lies in a general ignorance of the British Pharmacopœia, which ignorance is quite excusable up to a certain point. That book, intended to form a uniform standard and guide for medical men and pharmacists, is absolutely partial to the latter, and a sincere regard for it on the part of the doctor would fitly be described as bordering on the pathological. The book is not a compendium of drugs of certified values, but one of drugs in common use, some of which are standardized. The time seems both ripe and opportune for a departure from the present arrangement, and for a future issue to be divided into two parts—one medical the other pharmaceutical. The first-named would consist of pharmacology, therapeutics, principles of treatment, specific therapy methods of administration of drugs, and the general principles of incompatibility. Under the heading of each drug would be arranged its dose, medicinal property and solubility, prescribing notes, and the best method of presentation or exhibition, either singly or in combination.

The test of official recognition might depend on a plebiscite regarding its general use, on lines instituted by the late Mr. Martindale some years ago. Such a means would demand the credentials of a drug for entry into the pharmacopœia in the first instance, and subsequently revise its right to remain there. A ready method, and an abundance of material lie ready to hand in adapting or blending such works as the "Extra Pharmacopœia," "Squire's Companion," and the "Year Book of Pharmacy." In this way, utility would replace novelty, while security of tenure would obviously depend on the drug or remedy producing a constancy of result in a given field of therapeutic action. At present there is inconstancy or caprice or both, as witness the fact that the extract of bael was present in the 1885 edition, jettisoned in 1908, and restored in the 1914 copy. Dispensing on the part of medical men cannot cease too soon. The National Health Insurance Act has largely removed it from medical practice. A beneficent legislation would abolish it entirely, except under the most exceptional circumstances.

The pharmaceutical issue might remain much on the present lines, though suggested improvements would not prove

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Chloramine occurs in crystals, which, dissolved in water in 1-2 per cent. solution, is a most satisfactory antiseptic for the mouth and any jaw injuries. For irrigation of the bladder or uterus, 5 per cent. strength is used.

Hectone, Galy, and Intramine have been introduced as alternatives to salvarsan and neo-salvarsan, to which Ferrivine, an iron salt of sulphanilic acid, should be added. It should be noted that these, as indeed all the arsenical compounds, are still regarded as in the experimental stage, and have to be employed cautiously.

The synthetic bodies analogous in action to cocaine are Novocaine, Stovaine, and Tropacocaine. Novocaine should always be combined with adrenalin, and, as has recently been pointed out, sulphate of potassium added as well enhances and prolongs the anæsthetic effect. Stovaine, combined with glucose, has its rôle in spinal anæsthesia, though by some operators tropacocaine is preferred. The ergot class is reinforced by Ernutin, Ergamine, and Tyramine. Pituitrin is regarded in obstetric practice as a sovereign remedy in secondary uterine inertia, as a powerful aid in surgical shock, while 1 cc. injections every four hours are stated to be of great service in acute pneumonia.

The ethyl ester of morphine termed Dionin has come into extensive use in ophthalmic practice, for it neither dilates the pupil nor increases the intraocular tension. An ointment of four grains to the ounce gradually increased to twelve grains constitutes the best of all methods for corneal opacities. Another opium derivative, Omnopon, originally introduced as Pantopon, is stated to contain the alkaloids of opium in the form of soluble hydrochlorides. One grain is regarded as the equivalent of five grains of opium or of seventy-five minims of tincture of opium. Its good qualities are enhanced by combining it with Scopolamine.

an insuperable task, and it would continue as the presumptive standard of purity of drugs. The present anomaly of making appeal to it in prosecutions under the Act, concerned with the sale of food and drugs, might then be abolished by stating in the Act that a drug must conform to the standards of that work, an improvement on the present loose terminology, viz., "which is not of the nature, substance, and quality demanded by the purchaser."

Though perhaps not quite germane to the present subject, a wise move on the part of the Pharmaceutical Society would be to alter and extend the scope of the "major" examination which confers on the successful candidate the title of "Pharmaceutical Chemist." At present, the qualification is of nominal value. This is unfortunate, since the standard required is a high one, and the attainments are of high scientific value, a fact not generally known. Such an examination might be altered to include clinical pathology, bacteriology, and histology. A wide field of usefulness would be opened up in place of the present restricted one. For example, there is no reason why the work, at present carried out in clinical laboratories, should not be done by such pharmaceutical experts. These latter should receive in these subjects both university tuition and correspondent recognition. Swabs from throats are examined and reported on by a chemist in the county of Westmorland at the present time. This domain exists quite apart from the opportunities which, under the present crisis, should immediately become available in the sphere for the manufacture of pure chemicals and synthetic remedies.

In regard to some more recent arrivals of newer remedies three additions to the antiseptic group may be noted.

Eupad—a name coined from the first two letters Edinburgh University, and pad, from the pathological department—consists of equal weight of finely-powdered bleaching powder and powdered boric acid. From this, by the addition of water, is obtained another antiseptic much in vogue at present, viz., Eusol. The formula given by the authors consists of 12·5 grams of bleaching powder and 12·5 grams of boric acid to a litre of water. The solution contains approximately 0·27 per cent. of free hypochlorous acid, which is the active agent.

Distribution to the patient is made by means of a number of large metallic electrodes applied to the trunk and limbs, the supply to each being controlled by a suitable rheostat, and being changeable to either polarity at choice. The electrodes for the back, buttocks, and backs of the thighs are mounted to form the back and seat of a chair, on which the patient assumes a semi-recumbent position preparatory to treatment, whilst the remainder are kept in place by the pressure of weighty sandbags. These serve the additional purpose of preventing the muscles from any great shortening upon stimulation, thus tending to diminish disagreeable sensation to the patient, and to promote the greater production of heat by rendering the contractions isometric. Finally, the rhythm of the muscular contractions is obtained by a mechanically operated rocker device, on the principle of a Pohl's reverser, which interrupts and reverses the current some 120 times a minute.

The original purpose of the apparatus was to fill an essential place in the cure of obesity. Its suitability for this is at once evident; it provides, with safety, an amount of exercise which the majority of patients could not hope to equal by personal effort.

Unfortunately, its suitability in another direction is equally evident. A "safe" current, a novel and exhilarating treatment, an appeal especially to the æsthetic side of womanhood, constitute fertile ground for the advertising quacks, whose "inexactitudes" have already thrown some shadow of discredit.

Nor are some members of our own profession entirely above criticism, inasmuch as they are guilty of prescribing the treatment without a proper understanding of its limitations. The cure of obesity depends, fundamentally, upon creating an expenditure in excess of receipts. Obviously, it is easy to nullify the effects of the apparatus by allowing the patient to take inappropriate food. It must be distinctly understood that *strict supervision of the diet forms an essential part of the system*. Further, it is eminently desirable for the patient to take as much reasonable voluntary exercise as the physical conditions will permit. Without these two complementary factors—strict diet and voluntary exercise, when possible—and without skilled gradation of the strength

A NOTE ON PASSIVE ERGOTHERAPY IN OBESITY.

By J. S. KELLETT SMITH, F.R.C.S.

IN 1913, I visited the clinique of Prof. J. Bergonié, at Bordeaux, with the object of estimating how far his principle of electrically stimulating large muscle groups could be adapted to the benefit of certain cases of lateral curvature of the spine. Since that time I have employed his machines, not only for this and other restricted purposes, but in their wider scope as applied to various metabolic and circulatory disorders. The results have convinced me that his method of "muscular work electrically excited and involving all the muscles of the body"—or, as he afterwards tersely named it, "Passive Ergotherapy"—constitutes an extremely valuable form of treatment, which presents many unique advantages, and which must take a permanent place amongst physiological measures of cure.

The method may be defined more particularly as an application of the Faradic current, by which the skeletal muscles, in their entirety or in separate chosen groups, may be thrown into rhythmic contraction—varied at the will of the operator in rate and intensity—without discomfort or fatigue to the patient, without strain upon the heart, and with a beneficial effect upon the muscles themselves. The idea of employing the electrically provoked activity of the muscles as a therapeutic agent is by no means new, but has never been practicable to any worthy extent until the perfection of the present apparatus. It needs little imagination to appreciate the wide field thus opened up.

I do not propose, in this short paper, to enter into minute technical details of the apparatus and its operation.¹ Suffice it to say, that the primary current may be derived, if the main supply is unavailable or undesirable, from Leclanché cells, and that the Faradic current is provided by a coarse-wound coil, capable of giving a large output at a low voltage.

¹ These may be gathered from the Author's recent work, *The Cure of Obesity and Obese Heart*.

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of the rhythmic contractions in each individual case, we have no right to expect good results. Yet I have heard a practitioner, at our leading Spa, condemn the method because it had failed in nine consecutive cases—the cases, by the way, having been handed over for their entire treatment to a nurse at the Corporation Baths! And I have in my possession several letters from medical men, asking advice in similar difficulty. On investigation, it was found in every instance that the question of diet had been quite neglected. Bergonié has insisted, time and again, upon the importance of this point, which, after all, is only common sense.

If, then, diet and voluntary exercise are factors in the treatment, the question at once comes—"Cannot the result be equally well obtained by diet alone, or by exercise alone, or by a combination of the two?" What, in other words, is the exact rôle of passive ergotherapy?

All subjects of obesity, except those who suffer from some unusual pathological condition which modifies their metabolism, such, for example, as minor hypothyroidism, may be regarded as being caught up in a simple vicious circle. The recurrent points of this are (1) Obesity, (2) Incapacity for muscular effort, (3) Saving, in the form of fat, from even a moderate diet. In young people, whose obesity is recent, the incapacity for muscular effort is relative only, and may be remedied without much trouble. Their muscles are usually in fair condition, and the general sluggishness and disinclination for movement are due, primarily, to faulty katabolism. This is quickly corrected by passive ergotherapy; exercise is administered to them in measured doses, as it were, without any effort whatever on their part, and the result is a speedy restoration of physical and mental energy and of the consequent capacity and desire for muscular work.

The real test is found in cases of the chronic obesity of later life. Here the muscles are "flabby" and infiltrated with fat, and physical activity is further apt to be severely limited, either by some consequence of the obesity itself or by some independent malady. The most usual trouble arises from the heart, either from a simple physiological inadequacy, from fatty overlay, infiltration, or degeneration, or from inhibition through vagus irritation caused

by abdominal ptosis and mesenteric drag. Bronchitic troubles are frequent as well. Painful foot-strain, due to excessive superincumbent weight, is met with in a great number of cases, whilst a surprisingly large proportion present rheumatoid knees.

It is obviously impossible to place much hope in voluntary effort alone as a curative agent for these people. Exhaustion arrives long before whatever exercise is performed is sufficient to influence their metabolism to any degree of good.

Nor does the employment of a restricted diet alone give better hope. Obese persons, using up a minimum of energy in muscular movements, are able to make an alimentary saving in the form of fat even from a very moderate supply of food, and more especially so since their general surroundings, habit of ample clothing, and frequently short stout build, all lead to economy in radiation of body heat. It is a truism with such people that their burdens increase, even although they eat very little. Therefore, a curative diet with them means a starvation diet—something between 1,000 and 1,500 Calories per day—and this is practicable in only a small minority of cases. After a little time many patients are compelled to abandon the attempt on account of general troubles, *e.g.*, faintness, nausea, headaches, insomnia, depression, confusion of thought, and incapacity for mental effort. Even when better tolerated, the results are very slow, and the weight is apt to rise again immediately any relaxation is permitted.

Passive ergotherapy provides the only easy way out of the difficulty. It acts quite independently of the patient's will, and demands no expenditure of capital energy; its application is not restricted by any crippling condition of the joints, and, whilst avoiding any dangerous strain upon the heart, it provides an amount of exercise sufficient to start a more or less rapid lypolysis. With the internal reserves thus made freely available, it is the usual thing to find that the patient's appetite diminishes, in spite of the muscular work electrically excited, until all desire is satisfied with a small amount of food and a very slender diet is supported with absolute comfort. The vicious circle of obesity is thus successfully attacked at two causal points: the incapacity of the muscles is negated, and the food supply

is reduced without difficulty below the figure of expenditure.

Perhaps the most interesting and surprising feature, in many cases of all ages, is the rapidity with which physical activity may be regained under treatment. One is made to realize that an extra body bulk of a very few pounds may make all the difference, for example, between an adequate and an overburdened heart. Take the following case:—

CASE M. D., f., æt. 65 years. Height, 5 ft. 1 in. Weight (net), 16 stone $1\frac{1}{2}$ lb. Breathlessness and palpitation upon the slightest exertion. All exercise had been given up, her bedroom had been moved to the ground floor, and her only excursions consisted of an occasional visit to the neighbouring church. Asthma and bronchitis had troubled her during the last few winters, and were tending to become chronic.

There was marked œdema of the ankles. No albumen. The heart was in good muscular condition, despite the extreme obesity and her age, but was evidently overburdened as soon as any effort was called for.

She was given a short course of treatment, comprising 19 sittings in 28 days. In this time she lost 12 lb. in weight, the œdema quite disappeared, and on the final day of the course she walked $2\frac{1}{2}$ miles, partly uphill, without any distress whatever.

After her return home, she continued her voluntary exercise and moderate diet, and was able to report in four months a further loss of $19\frac{1}{2}$ lb.—making a total of $31\frac{1}{2}$ lb., whilst, as regards general condition, she adds:—"I am very well and active, and ten years younger in feelings. I walk up hills with very often no break to breathe, and go a good fast pace."

Or, as an example of a different type of heart complication, the following:—

CASE V. B., f., æt. 29 years. Height, 5 ft. 4 in. Weight (net), 15 stone 4 lb. She had been forbidden all exertion, both by her own doctor and a consultant, on account of fatty heart. Any exercise, beyond slow walking on the level in a still atmosphere, produced immediate breathlessness and general cardiac distress.

Her age was all in her favour, and, with the help of passive ergotherapy, she was able to begin heart-training by graduated walking exercise, almost at once. In two weeks, after a loss of 11 lb., she could take a gradient of 1 in 17·4 with ease; in a month, after a loss of 20 lb., she was able to walk up Beachy Head without distress.

The first course of treatment finished in $5\frac{1}{2}$ weeks, with a loss of 24 lb. An interval of 18 days was then allowed, during which she went down a further 5 lb. She was then given a second course, lasting a month, which reduced her an additional 11 lb. The total loss was 40 lb. in three months, and her activity was fully restored.

No less striking is the change in some of the other

conditions which are common in obesity. The connection between reduction of weight and the relief of painful flat-foot, for instance, is obvious; it is not so obvious in abdominal ptosis, or the enlarged, painful, crepitant knee-joints of many obese people. Yet the results of passive ergotherapy in such cases are sufficient to throw a broader light upon their treatment, and to give reduction of weight an important place as an element in their cure.

Weakness of the abdominal muscles is a notorious sequence of child-bearing, especially in women with pronounced lumbar curves, and is often the immediate forerunner of the most distressing form of abdominal obesity. Sufferers from the worst degrees of this complaint lead wretched lives; their circulation is not responsive to muscular activity, owing to the abdominal stasis and to the effect of mesenteric drag upon the nerve control of the heart. Even moderate movement brings on a feeling of faintness, and the patient is apt to become neurasthenic, and to degenerate, as time goes on, to a "chair and sofa" existence. The various operations proposed, some on the major scale, do not give encouraging results, and a measure of relief is generally sought in wearing a more or less uncomfortable abdominal belt.

Passive ergotherapy is admirably suited for the treatment of this insidious complaint and all its attendant evils. Since these patients often have quite normal slender limbs, the chief strength of current is directed to the abdominal muscles. During a sitting of 45 minutes, with the reversing rocker working at 120 per minute, these can be thrown into contraction under a heavy weight (easily up to 112 lb.) no fewer than 5,400 times, half of which contractions will be strong; and half weak, according to the varying polarity of the abdominal electrode. The result is an exercise and strengthening of the parietal muscles, such as is obtainable by no other means, a thorough massage of the abdominal contents, and a rapid absorption of abdominal fat.

CASE M. T., æt. 52 years. Height, 5 ft. 3 in. Weight, 12 stone 5½ lb. Multipara. Complains of constant tiredness so complete as to be almost painful, lack of all energy, and quick fatigue upon exertion. She dates all this from the birth of her last child, 12 years ago. Her mental depression is so profound as to cause anxiety to her friends.

The limbs are slender and delicately shaped. The abdomen pendulous and very large. Systolic blood pressure 114.

The weight was reduced 14 lb. in five weeks, especial attention being given during treatment to strengthening the musculature of the abdominal wall.

Upon examination, eight months afterwards, the abdomen was flat, and the viscera were well supported. A further decrease in weight had taken place. Systolic pressure 138. She had recovered all her old energy and initiative, and was actively engaged in supervising a canteen and amusements hut at a training camp.

It is not too much to claim that cases of this type are removed by means of passive ergotherapy into a more hopeful category than they have ever occupied, and the same may be said of many cases in which activity is limited, and the vicious circle of obesity initiated, by the familiar kind of knee-joint mischief described above. Two facts are generally accepted as regards these joints : (1) that they have a close connection with an alimentary toxæmia ; (2) that all toxins in the circulation find their most ready seat in a joint subject to injury. Experience has convinced me that the constant slight percussion traumatism, from carrying a too heavy body, is a decided factor in prolonging the course of these cases, and that the reduction of superincumbent weight is productive of much relief.

The further indications are to improve the state of the alimentary canal, with a view to checking the absorption of intestinal toxins, to diminish periarticular thickening, to promote the absorption of articular fluid, to loosen adhesions in the tendon-sheaths, to restore muscles which have become atrophied through disuse and limitation of their range of action, and to re-educate such muscles after their long period of partial physiological inhibition. All these indications are met successfully by the practice of passive ergotherapy, and the results are amongst the most gratifying in the whole range of the treatment.

CASE D. A., æt. 67 years. Height, 5 ft. 4 in. Weight, 14 stone 3½ lb. A short, stout man, florid-complexioned, with varicose veins in both legs, and rheumatoid knees which rendered each walk a pilgrimage of pain. Is growing more and more incapable of getting about, and is becoming greatly "troubled by his breathing."

He commenced treatment in September, 1913, and was reduced 17½ lb. After this he went slowly down, by attention to diet and by

using his recovered powers of voluntary exercise, until he reached a little above 11 stone; up to the present time, he has always kept between 11 stone and 11 stone 6 lb.

His knee-joints are much better in themselves—as well, in fact, as the previous amount of anatomical change in the cartilages will allow—and, with the relief of the superfluous burden of 3 stone, he is able to move about with a freedom and buoyancy in marked contrast to his former state.

The most important advantage of passive ergotherapy lies in its relation to the dynamics of the circulation.

At first thought, it might appear that a simultaneous rhythmic contraction of all the skeletal muscles (except those of the head and neck) would throw a dangerous strain upon a fatty heart. But it is not so. The disturbance of the circulation is much less than occurs during voluntary effort.

We know that in voluntary exercise the increase in pulse-rate and in blood-pressure is due, to a great extent, to the necessary effort of will. Now, passive ergotherapy demands no effort of will whatever, for the muscular work is initiated and controlled entirely by the operator. So complete is the detachment of the patients' minds that they converse or read at their pleasure, or may even be lulled to sleep during a treatment by the monotonous hum of the hammer of the coil. It is clear, therefore, that they are spared the exhausting effects of voluntary effort upon the heart and circulation.

We are thus left to consider only the ordinary direct results of muscular action in assisting venous return and in dilating the peripheral blood-path. It is important to realize that in passive ergotherapy these occur in such degree, and so modify the circulation, that the disturbance of the heart from normal is astonishingly small in relation to the great amount of work done.

In the average case of obesity, the following are the usual observations during a sitting :—

The heart rate is slowly accelerated 10–25 beats per minute, chiefly owing to chemical and thermic changes in the blood. At the same time, the volume of the pulse increases and dicrotism becomes more marked, thus giving evidence of greater systolic output against diminished peripheral resistance.

The minimum and maximum blood pressures are

raised to a small degree in the majority of cases: the former, 5-15 mm.; the latter, 10-25 mm. In some subjects of high systolic pressure (over 170 mm.), when the high reading is due to faulty katabolism, and retained toxins, a fall may occur in the maximum, and a slight diminution or no change whatever in the minimum.

The respiratory movements are increased in depth. After a little time, the need for a greater supply of oxygen may increase the rate as well, but not to any great extent, and never to anything approaching "panting." This is another of the points of superiority of passive ergotherapy over voluntary exercise, and permits its employment in the emphysematous and in cardiopaths.

The body temperature is raised, and shows an increase of from 1° to 2° F. at the end of the sitting.

The skin becomes active, and perspiration is induced in consequence of the body heat engendered by the muscular activity. The capillaries of those tracts of skin in contact with the electrodes become widely dilated, in consequence of the direct effect of the current upon the cutaneous nerve endings.

These figures, regarding the rise in pulse-rate and blood-pressure, are taken from an account given by Prof. Bergonié. I have never been able to reach his maxima, except in cases in which the initial readings were decidedly lower than normal. In personal experiments undertaken for this purpose, with extremely vigorous contractions lasting for one hour, and with a weight of 132 lb. on the abdomen and legs, my figures were always much as follows:—

	Pulse.	B.-Pressure.	Respirations.	Temp.
At start - - -	76	138	14	98.2
After 60 minutes -	92	150	18	99.0

But more instructive, perhaps, is the record of an obese cardiopath, such, for example, as the case M. D., reported above. The treatment here was also very energetic, but the

weights used were not so heavy.

	Pulse.	B.-Pressure.	Respirations.	Temp.
At start - - -	88	159	18	98.0
After 15 minutes -	90	162	20	—
„ 30 „ -	86	164	26	—
„ 45 „ -	88	166	24	—
„ 60 „ -	90	164	23	99.2

(Sandbags on thighs and abdomen = 56 lb. for 15 minutes, then 84 lb. for the remainder of the hour.)

Immediately after the sitting, the respirations become normal; there is no period of breathlessness. If any change at all is noticed, it is in those who are “bad breathers” (bronchitics, cardiopaths, etc.), and is then all to the good, for in them the respirations are found invariably to be more even, deeper, and free from obvious effort.

The pulse-rate diminishes rapidly, and may become, for a little time, less than at the beginning of the application.

The blood-pressure drops in most cases a few mm. below the patient’s usual reading. The fall is transitory, and the normal is speedily restored. But in those cases of initial high pressure, already alluded to, in which a fall may take place during the actual treatment, then such a fall may partly persist, owing to the more complete metabolism following muscular activity together with the stimulus to general elimination.

Results such as the foregoing show that the hypotensor (the great assistance to the venous return, the peripheral vaso-dilatation, the deep free breathing), and the hypertensor (acceleration and greater output of the heart) factors so balance, that the conditions under which the general contractions of passive ergotherapy are produced are actually those most favourable to the cardio-vascular function.



raised to a small degree in the majority of cases: the former, 5-15 mm.; the latter, 10-25 mm. In some subjects of high systolic pressure (over 170 mm.), when the high reading is due to faulty katabolism, and retained toxins, a fall may occur in the maximum, and a slight diminution or no change whatever in the minimum.

The respiratory movements are increased in depth. After a little time, the need for a greater supply of oxygen may increase the rate as well, but not to any great extent, and never to anything approaching "panting." This is another of the points of superiority of passive ergotherapy over voluntary exercise, and permits its employment in the emphysematous and in cardiopaths.

The body temperature is raised, and shows an increase of from 1° to 2° F. at the end of the sitting.

The skin becomes active, and perspiration is induced in consequence of the body heat engendered by the muscular activity. The capillaries of those tracts of skin in contact with the electrodes become widely dilated, in consequence of the direct effect of the current upon the cutaneous nerve endings.

These figures, regarding the rise in pulse-rate and blood-pressure, are taken from an account given by Prof. Bergonié. I have never been able to reach his maxima, except in cases in which the initial readings were decidedly lower than normal. In personal experiments undertaken for this purpose, with extremely vigorous contractions lasting for one hour, and with a weight of 132 lb. on the abdomen and legs, my figures were always much as follows:—

	Pulse.	B.-Pressure.	Respirations.	Temp.
At start - - -	76	138	14	98.2
After 60 minutes -	92	150	18	99.0

But more instructive, perhaps, is the record of an obese cardiopath, such, for example, as the case M. D., reported above. The treatment here was also very energetic, but the

weights used were not so heavy.

	Pulse.	B.-Pressure.	Respirations.	Temp.
At start - - -	88	159	18	98.0
After 15 minutes -	90	162	20	—
„ 30 „ -	86	164	26	—
„ 45 „ -	88	166	24	—
„ 60 „ -	90	164	23	99.2

(Sandbags on thighs and abdomen = 56 lb. for 15 minutes, then 84 lb. for the remainder of the hour.)

Immediately after the sitting, the respirations become normal; there is no period of breathlessness. If any change at all is noticed, it is in those who are “bad breathers” (bronchitics, cardiopaths, etc.), and is then all to the good, for in them the respirations are found invariably to be more even, deeper, and free from obvious effort.

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THE CLINICAL SIGNIFICANCE OF SINUS
ARRHYTHMIA.

By LESLIE THORNE THORNE, M.D., B.S., ETC.

Late Medical Examiner L.C.C. Technical Education Board.

SINCE the invention of the polygraph and the electro-cardiograph, it has been possible to classify the irregularities of the heart's action, and to distinguish those which are of serious import from those which are comparatively harmless. Before the introduction of these instruments and the discovery of the nervo-muscular structures, forming the sino-auricular node and the auriculo-ventricular bundle and its branches, cardiac irregularity of any kind was always regarded with grave suspicion, for it was not then possible to differentiate with certainty between the various forms of irregularity.

The careful physician, knowing that he was treading on uncertain ground, had to be guarded in his prognosis and on the safe side in his treatment, in any case in which the normal regularity of the heart beat was affected. In consequence, many cases, especially amongst children, were condemned, unnecessarily, to a very restricted and unhealthy life.

The pendulum has now swung in the opposite direction, and many cardiologists maintain that certain irregularities, especially those which are due to vagus influence, can be disregarded, both from the point of view of prognosis and treatment. This attitude is the natural result of the realization that the teaching of the past on this subject was faulty, but it does not allow for the facts, that these new methods of investigation are of comparatively recent date, that the effects of cardiac irregularities are often not apparent for years after their development, and that they often lie dormant till some extra strain on the muscular or nervous system brings them suddenly into prominence.

The present war has demonstrated in numbers of cases that hearts supposed to be perfectly sound, and fulfilling their functions satisfactorily in the ordinary routine of life,

have broken down entirely under severe and unusual strain.

I am convinced, from observation of many cases in adults, especially young adults, that the presence of any kind of irregularity in the cardiac rhythm is not a normal condition, and that it should not be disregarded. In all cases in which it is present, a careful enquiry into the previous history, and a detailed examination of the heart, to ascertain the presence or absence of dilatation, should be made, before the sign of irregular rhythm is set aside as a matter of no importance. It stands to reason that an organ which is working irregularly, whatever form that irregularity may take, is not in as satisfactory a condition as one which maintains a regular rhythm.

During the last twelve months, I have had under my care a number of officers, mostly young men, who have been invalided from active service on account of cardiac breakdown, the result of the unusual strain and responsibility of life at the front. These patients, without exception, have been passed for service as physically sound, but, on careful enquiry, I have always obtained a history of former heart trouble, such as a strain in school athletics, necessitating a long rest, or an attack of rheumatic fever in childhood. I have been struck with the fact that, in the large majority of these cases, the only signs of abnormality of the heart present were slight cardiac dilatation and marked sinus arrhythmia. The most prominent symptom has usually been a severe form of general debility and exhaustion, so that the patient has been quite incapable of any sustained effort, either of body or mind, despite the fact that he has usually had a period of entire rest from work of some months' duration. Under treatment, the cardiac dilatation has disappeared, the patient has recovered from the condition of exhaustion and debility, has been able to take moderate exercise with enjoyment, and gradually to resume his ordinary habits without any return of the sensation of collapse, that formerly accompanied any effort whatever. The sinus arrhythmia has usually become less marked, but it has generally persisted to a certain degree, and I am, therefore, led to believe that this arrhythmia was not a new development, but that it had probably been present for a long period.

The following cases of two young officers, whose hearts have broken down on active service, are illustrative of many

others, and the polygraph tracings show no abnormality, except a marked sinus arrhythmia; the hearts in both cases were somewhat dilated.

CASE I.—Captain J., age 21 years, was sent to me on March 20, 1916, by Dr. Arthur P. Luff, who informed me that the patient had been under his care, taking heart tonics and resting from work, since January 26, 1916, and that, as his cardiac condition did not improve markedly, he had advised a course of "Nauheim" baths.

The history of the case is as follows:—At eleven years of age he suffered from severe dilatation of the heart, after a seven miles' paper-chase, was in bed 8 weeks, and not allowed to play any games for three years. In July, 1915, he suffered from severe shell concussion in France, was laid up in hospital for seven weeks, and then put on light duty; since that time he has had seven medical boards, and has always been reported as only fit for light duty. In December, 1915, while out shooting, he was attacked with vertigo, collapse, and syncope, and shortly after this he consulted Dr. Luff.

When I first saw the patient, on March 23, 1916, he looked in good health, his pulse, in the recumbent position, was 88, and, in the erect, 112 per minute, and was of marked sinus arrhythmia; his blood-pressure was 70–150 mm. Hg.; a blowing systolic murmur was heard over the aortic area, on lying down, but was not heard in the erect position, and the first sound at the apex was reduplicated. The apex-beat was forcible, and just inside the left nipple line; the area of cardiac dullness extended from just inside the left nipple to nearly one inch to the right of the mid-sternal line, and measured nearly 4 inches across at the nipple level. A polygraph tracing, Fig. 1, showed a pulse of poor volume and of very marked sinus arrhythmia, the largest waves measuring 15 millimetres, as compared to 8 millimetres of the shortest. It will be seen from the tracing that the *a* — *c* interval is normal and that the "*b*" wave is well marked in the long waves. The "*b*" wave is caused by diastolic closure of the auriculo-ventricular valves at the end of the ventricular filling, the flow from auricle to ventricle is suddenly checked, and a reflex occurs into the jugular vein—the "*b*" wave.*

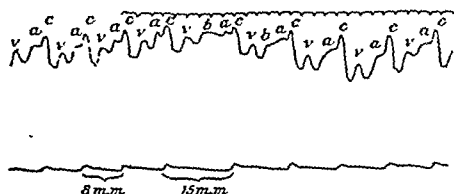


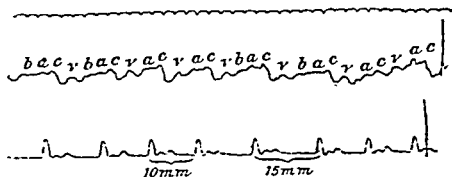
FIG. 1.—Polygraphic tracing before treatment, showing very marked sinus arrhythmia and a pulse of poor volume (Case I).

After a course of 25 "Nauheim" baths, the patient felt well, had lost the feeling of exhaustion, and was able to take exercise with enjoyment. The polygraphic tracing, Fig. 2, taken after treatment,

* Explanation of "*b*" wave. *Quarterly Journal of Medicine*, Dr. T. Davenport-Windle.

shows a pulse of improved volume, but the sinus arrhythmia is still present, as well as the "b" wave, in the longer waves. The area of cardiac dullness was normal, measuring about two and a half inches across at the nipple level. The blood-pressure was 50-115 Mm. Hg., as compared to 70-150 Mm. Hg. before treatment.

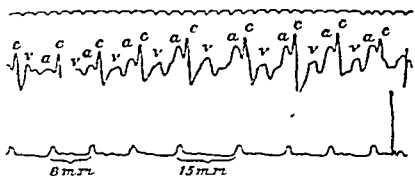
FIG. 2.—Polygraphic tracing, showing improved volume of the pulse, but persistent sinus arrhythmia (Case 1).



The sinus arrhythmia is not quite so marked as before treatment, the shortest pulse waves being 10 millimetres long, and the longest 15 millimetres, as compared with 8 and 15 before treatment; it was also not so constant.

CASE 2.—Captain L., age 30 years, consulted me in March, 1916. He had scarlet fever in 1907, followed by rheumatic fever. On December 28, 1915, he suffered from severe shell shock, followed by an attack of rheumatism early in January, 1916; since which time he had been laid up entirely. When I first saw the patient, he looked pale and flabby, he was incapable of any exertion, and could only move about his bedroom with the aid of two sticks, for the left leg and thigh were very stiff from rheumatism, and any movement caused palpitation. The area of cardiac dullness was enlarged, measuring five inches across at the nipple level, and extending from just inside the left nipple to the right border of the sternum; the apex-beat was just felt in the nipple line, the cardiac sounds were weak, but no murmur was present; the pulse was 96 per minute in the prone position, and 108 in the erect; the blood-pressure was 70-105 Mm. Hg. A polygraphic tracing, Fig. 3, showed a pulse of poor volume and of marked sinus arrhythmia, the longest wave measuring 13 millimetres, and the shortest 8 millimetres. The patient had been in bed for 2 months, and had had several weeks' massage, with only slight improvement of the stiffened limb; he was stiff in his neck and back, but there were no joint lesions.

FIG. 3.—Polygraphic tracing before treatment, showing sinus arrhythmia and poor volume of pulse (Case 2).



I advised a course of modified "Nauheim" baths, resembling the "Nauheim" baths in constituents, but at a higher temperature, on account of the rheumatism, and he went into a nursing home for that purpose. After a course of twenty-five baths, extending over

five weeks, he could walk about comfortably, without sticks, but with a slight limp. The area of cardiac dullness was normal, measuring about two inches across on the nipple level, and the apex-beat was one inch inside the nipple line; the rate of the pulse was 80 in the prone position and 92 in the upright position. The blood pressure was unaltered. The polygraph tracing, Fig. 4, shows a pulse of slower rhythm and improved volume. The sinus arrhythmia is still present, but is not so marked, the longest wave being 13 millimetres, and the shortest 11 millimetres, as compared to 8 and 13 millimetres before treatment.

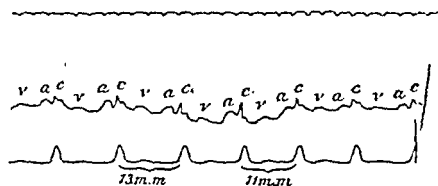


FIG. 4.—Polygraphic tracing after treatment, showing pulse of improved volume and slower rate, the sinus arrhythmia being still present in a less degree (Case 2).

The above cases are only two examples of many that have come under my notice, from the treatment and observation of which I have formed the following conclusions:—

1. The presence of sinus arrhythmia, which indicates an irregular cardiac dilatation, is not an absolutely normal phenomenon.
2. People in whom this arrhythmia is present are more liable to suffer from a cardiac breakdown, under mental or physical strain, than are those who have a perfectly regular pulse.
3. Any soldier who has had a cardiac breakdown, and whose pulse shows evidence of sinus arrhythmia, is not fit for active service abroad.

TREATMENT.

Absolute rest, except in the acute stage of the breakdown, is not advisable. When the patient is able to get about at all, he should take as much walking exercise a day as he can do without feeling done-up. A course of mineral baths, similar to those originally given at "Nauheim," should be prescribed, and, in some cases, massage is also useful. Drugs seem to be of little or no use in these cases, after a certain stage.



PROGNOSIS AND PROPHYLAXIS IN ECLAMPSIA.

By GILBERT I. STRACHAN, M.D.

Late Resident Obstetrician, the Royal Glasgow Maternity and Women's Hospital.

THE large amount of research which, in recent years, has been devoted to eclampsia, its causation and efficient treatment, has resulted in a great increase in our knowledge of the pathology of the condition, and has indicated certain lines of treatment. But we have not yet clearly isolated the cause, and opinion regarding treatment is hardly, even now, unanimous; on one point, however, all are agreed, namely, the vital importance of efficient prophylaxis. The established disease is one of the gravest conditions met with in medicine, and the mortality, both maternal and foetal, is still high. By efficient curative treatment much may be done, but it is mainly in prevention that we should put our trust, and take credit rather for the absence of the condition than for the most brilliant result of curative treatment. It is to emphasize this that I wish to indicate the lines along which, in my personal experience and opinion, prophylactic treatment should proceed. Prognosis may fittingly be considered here as well.

PROGNOSIS.

The outlook in a case of eclampsia is always doubtful, and often grave. We have to remember that death may be due, not only to the direct toxic effects characteristic of the condition itself, but to many of the frequent complications as well, such as cerebral or hepatic hæmorrhage. Obviously, if treatment be instituted early, and vigorously prosecuted, so that the disease is checked before these complications have arisen, the outlook is correspondingly brighter. The maternal mortality may be reckoned to be between 20 per cent. and 25 per cent., with a foetal mortality of from 35 per cent. to 50 per cent., but statistics collected from different sources differ greatly from one another. In the Birmingham Maternity Hospital, the mortality in recent years has been about 33 per cent. Tweedy reports, in 7 years of Rotunda Hospital practice, 74 cases, with a mortality of

8.1 per cent. Lush¹ gives the mortality in New York, from 1867 to 1875, as 1 death in 700 cases, *i.e.*, $\frac{1}{7}$ per cent. I must leave the reader to draw his own conclusions from this figure. Frankly, I am at a loss to explain so low a death-rate in unselected cases, and it is foreign to the experience of this disease. In the Royal Glasgow Maternity and Women's Hospital, from 1907 until 1911 we had 256 cases, with a maternal death-rate of 29 per cent., and a foetal death rate of 45 per cent. In my term of office there, we had 35 cases and 11 deaths—32 per cent. Stroganoff, of Petrograd, has recently published a series of 200 cases, with mortality 5 per cent., and, later, another series of 400 cases, with mortality 6.5 per cent. This is low indeed, but we have no reason to doubt the accuracy of the figures.

But, in considering hospital statistics, it must be borne in mind that these are derived from the worst cases, which naturally have the highest death-rate. Of these 35 cases, 5 died in periods varying from 20 minutes to 2 hours after admission, and, for these, no kind of treatment was going to be of any avail. Cases treated in general practice are usually likely to be milder, but for these statistics are seldom available. I consider that, if we could have statistics of all cases in hospital and in private practice, the death-rate would be found to be decidedly lower than the 20 per cent. usually quoted.

A number of factors must be considered as influencing prognosis, and amongst these are the number of fits present in an individual case. The number seems to influence the case in various ways. Commonly, it is stated, that the more numerous these are, the worse is the outlook. This is not necessarily so, however, and Jardine has reported a case (Edin. Obstet. Soc., March, 1906) which made a perfect recovery after having had over 200 fits. Mere frequency of fits *per se* would seem only to denote a specially excitable condition of the central nervous system, but a constantly decreasing interval between the fits is always of grave import, and, in my experience, unless energetic radical treatment be immediately instituted in such a case, a fatal issue can hardly be avoided. Again, frequency of convulsions would predispose to the appearance of such undesirable phenomena as hepatic or cerebral hæmorrhage, and, for this reason alone, we must consider frequency of

fits as influencing prognosis. Albuminuria is, of course, almost a constant feature in the disease, and it is difficult to know how much value to attach to this point in forming a prognosis. Theoretically, one would reason that the more albumen there is present, the greater will be the impairment of renal tissue, the lesser the excretory power, and the graver the outlook. Again, the tendency to future chronic renal disease is likely to be increased in such a case.

From these considerations, we may look upon heavy albuminuria as a bad omen for both the immediate and late outlook, but this view is by no means universally accepted. W. F. Shaw,² indeed, considers scanty albumen as a bad sign. Taking 10 grms. of albumen per litre of urine as a fair standard, he reports 21 cases with quantities below it—16 deaths—and mortality 61·9 per cent. 18 cases, with quantities above it, had 3 deaths, 16 per cent. mortality. These figures are expressive indeed, but a more extended series of cases requires to be investigated before we can dogmatize.

In our own cases, we could not say that heavy albuminuria exercised a malign influence on the immediate prognosis. Such cases usually made as full recovery as the others, and the urine cleared up as completely and quickly.

Another factor influencing prognosis is the height of the blood-pressure. Hæmorrhages into brain, liver, and kidney frequently occur; they are, perhaps, due mainly to chemical changes in the blood and affected organs, but high blood-pressure is, undoubtedly a causative factor as well, and for this reason alone we must look on a high and, especially, a continued high blood-pressure as a bad sign. This view is strongly supported by Bar.³ But, probably, one of the most valuable prognosis signs is the state of the ammonia-coefficient in the urine. Much attention has been directed to this important point in recent years, and very properly.

The end products of endogenous protein metabolism are ammonium carbonate and amino acids, especially the former. The ammonium carbonate is then, by the dehydrating action of enzymes in the liver, converted into urea, which is excreted by the kidney, but a certain very small proportion escapes this conversion, and is excreted as ammonium carbonate. Now, in certain conditions, and, markedly in toxic conditions complicating pregnancy, this final conversion does not occur, probably owing to injury of liver tissue by circulating toxins,

with subsequent impairment of function, and so a relatively greater amount of ammonium carbonate, and a relatively lesser amount of urea, appear in the urine, *i.e.*, the ammonia-coefficient is increased. The higher, therefore, the ammonia-coefficient is, the greater is the impairment of liver tissue and its consequences, the greater the amount and the greater the virulence of the circulating toxin, and the greater the disturbance of metabolism; all of which factors necessarily blacken the outlook. Reddy,⁴ of Montreal, considers the amount of diminution of urea to be the best prognostic index. As a low urea index is practically always accompanied by a high ammonia index, this is practically our own expressed view.

However, apart from actual mortality prognosis, the morbidity prognosis is certainly influenced in eclampsia. *Post-partum* sepsis, especially in its milder forms, is certainly prone to occur. It is often stated that post-partum hæmorrhage is very liable to occur, but my own experience is quite the contrary of this. In none of our 35 cases was there any sign of post-partum hæmorrhage; indeed, the amount lost was usually less than normal, and, in some cases, it would have been gladly welcomed. Finally, the tendency to future chronic nephritis must be increased, especially in the severer cases; this is a point on which one cannot produce figures, but from clinical observation, I am convinced that it is so. It is questionable, however, if any of these factors influence the outlook so much as efficient treatment or the lack of it.

PROPHYLAXIS.

Eclampsia is certainly preventable. Edgar and some others dogmatize that it is absolutely so, but, from our knowledge of the pathology of the condition, I cannot, personally, go so far in my views. Undoubtedly, however, the great majority of cases could be prevented, and of no disease can it be more fittingly said that prevention is better than cure. Again, the prognosis and prophylaxis in this disease are very closely related, and few things influence the outlook so much as the amount and quality of efficient prophylaxis. The maternal mortality is usually reckoned as about 25 per cent., and, obviously, to prevent the appearance of so dangerous a condition is much more satisfactory than to step in to the established condition,

with even the most efficient treatment.

The first point about prophylaxis is, clearly, that in the great majority of cases it must be carried out by the general practitioner. If the condition develops fully, the consulting obstetrician may then be called in, or the patient sent to hospital; but for the months before parturition it is the general practitioner who has to be on guard to see, as early as possible, the first premonitory signs of the condition, to treat with energy the early toxic manifestations, and, finally, if the condition develops fully, to institute curative treatment. It is, then, especially to general practitioners that these remarks are addressed.

The possibility of eclampsia developing in any particular case should be borne in mind by the practitioner, when he is engaged to attend any woman, especially a primipara. He should then appoint an early date, when he can fully examine his patient in bed. The general condition, the state of the tongue and teeth, the condition of the bowels, the presence or absence of oedema, the duration of the pregnancy, and the condition of the circulatory system, should all be investigated, and a specimen of urine examined. Presence or absence of albumen, and the relative amounts of urea and ammonium carbonate must be estimated. Of these, the ammonia-urea coefficient is certainly the most important point to which to pay attention, but it is only fair to assume that most practitioners have not the apparatus for such an estimation. Many cannot afford the necessary time, although when one has performed the formalin test a few times, it does not take long to do, while the necessary apparatus is simple. But in most cases, in practice, the presence or absence of albumen will be the point mainly attended to. The specimen of urine need not, at first, be obtained by catheter; indeed, if always free of albumen, the catheter is not necessary. If, however, albumen appear, a catheter specimen must be obtained to determine whether the albumen comes from the kidneys, or is due to fouling by vaginal discharge.

If all is found well, the patient should be advised about her general mode of life. She should eat light and easily digested food, varied according to taste, and ensure a thorough but quiet evacuation of the bowel; drastic purges are to be avoided. In this respect, aloin, cascara, and calomel are the best drugs to use. One drachm of liquid extract of

cascara at night may be given at first, and the dose increased or decreased, until we find, by experience, how much in each individual case is sufficient, and no more, to ensure a daily action. A most satisfactory drug is the Cascara Evacuant (P.D. & Co.), which may be administered in the same way. Calomel; gr. j., repeated hourly for three doses, with salol, gr. 5, also serves very well.

She should be out of doors for some time each day, and should take suitable exercise; a quiet walk or a drive in a rubber tyred vehicle do very well, but such things as horse riding or fast motor driving are strictly to be avoided. Sleep must be plentiful, and fully eight hours nightly should be secured, as well as, if required, a nap in the afternoon.

But the most important single injunction to the patient is, to notify the medical attendant immediately on the occasion of any divergence from normal good health, and especially on the onset of headache, giddiness, epigastric pain, troubles of vision, or cedema. If this is about the sixth month, and all is well, she may be left, and a second and similar examination made about four weeks later. Then if all is well, another visit may be paid after three weeks', another after a two weeks' interval, and, finally, weekly until parturition. These examinations need not take long. Probably, in most cases not more than about 20 minutes need be spent on each visit, and less on the final and more frequent ones, but no time will be more profitably spent. If all goes well, the accoucheur can present himself with confidence at parturition, with a full mental picture of the physical state of his patient. If toxic symptoms develop, the practitioner is informed of it at the earliest possible moment, when treatment has the best chance of being effective. But, if premonitory signs of toxæmia appear, we must immediately institute prompt and energetic measures to attempt to prevent the development of the full clinical picture. Again let us insist that the earlier these are begun, the better the chance of success. On the appearance of the slightest sign of toxæmia, the patient should be confined to bed, and given a saline purge. Calomel gr. iii. at night, with one drachm of Epsom salts on the following morning, does very well. The good so often resulting from this is mainly due to the clearing out, with the bowel-contents, of some fluid from the intestinal veins. It is very question-

able, in view of recent work, if calomel is the hepatic tonic it was supposed to be, but, in any case, we may give it the value of the doubt, for it is an efficient purge.

Dietetic considerations enter largely as well. Usually a milk diet is rigidly enforced, and meat is entirely cut off. Two or three pints of milk should be taken daily. But some observers, Tweedy amongst them, regard milk dieting as of no value, and, indeed, harmful. Now meat contains much protein, and the amino acids and ammonia resulting from its digestion throw much work on the liver in converting them into urea, and if the liver be flung out of action, the ammonia coefficient rises, as indicated above. Therefore, there is sufficient reason for excluding meat (protein) from the diet; but milk, too, contains a fair amount of protein (3 per cent. caesinogen), so it is far from being a protein-free diet. On this account, certain observers now strongly advocate the cutting out of both meat and milk, and feeding the patient on glucose alone; this is absorbed as such, and requires no digestion. 10 to 15 ozs. is usually sufficient. Longridge⁵ advocates this treatment, and points out that although he often gave large quantities of glucose, none ever appeared in the urine.

The rationale of starvation is indeed sound. The patient is in bed, so that the amount of nourishment required is small; the alimentary canal can be thoroughly cleared, and an important source of toxic absorption eliminated, whilst a rest is given to the digestive organs. All these points are, obviously, beneficial and important.

Attention must be paid as well to the other excretory channels. Free perspiration and diuresis are best induced at this stage by large draughts of tepid water, barley water, lemonade, or some similar innocuous drink, after which the patient may be wrapped in blankets and surrounded by hot-water bottles, properly guarded. This will be found efficient and not depressing. Under such treatment, many cases, perhaps the majority, will be relieved of their toxic symptoms; thereupon, a gradual return to the normal method of living may be allowed. Meat, however, even under the best conditions, must be sparingly, if at all, allowed, and never more than a small quantity once a day. Extractives, *e.g.*, beef tea, must on no account be allowed, for they are full of purin bodies, which fling a heavy strain on the liver during their conversion into urea. Even under the

NOTES ON BEARER WORK AT THE FRONT.

BY CAPTAIN HENRY W. SPAIGHT, R.A.M.C.

THE training in all branches of the Army has been altered in many particulars, during the past eighteen months, in order to meet the requirements of modern warfare. The work of the R.A.M.C. field-units has required a certain amount of modification from the excellent training laid down in the Training Manual, and some notes on the work of a field-ambulance bearer sub-section, gathered from actual experience in the field, may be of service to those engaged in training field-ambulance units at home.

Each section of a field-ambulance contains a bearer sub-division of 36 bearers, with four waggon orderlies in the case of "A" section, and three waggon orderlies in "B" and "C"; each bearer sub-division in charge of an M.O. with a sergeant. The ten ambulance waggons allotted to a field-ambulance consist of seven motor and three horsed waggons. These are allotted, three motor-ambulances to "A" section, two to "B" and "C," and one horsed ambulance to each section. The horsed ambulances are usually employed at the advanced dressing stations, established by the unit, and the motor ambulances only used for collecting from the aid-posts and trenches. The bearer sub-divisions are billeted, or bivouaced, in the neighbourhood of the main dressing station, where the ambulances are parked as well. Two bearer sections are used at a time, the third usually being held in reserve.

It is, as a rule, impossible for the bearers, with their ambulances, to approach the regimental aid-posts during the daylight, owing to shell fire; consequently, all collecting has to be done in the dark, and the training of bearers in stretcher and waggon drill in the dark is very important.

The usual collecting routine is, for six motor ambulances to leave the waggon park as soon as it is sufficiently dark for their purpose, divided into two convoys of three waggons, each convoy in charge of an M.O., with bearers varying in number from six to 36, according to orders, based on the

number of casualties reported during the day or evening. When an attack has been in progress, the full number will be required, but in the ordinary day's trench warfare, six will probably be quite sufficient. The officers in charge will agree to rendezvous, if possible, at a point where their collecting zones touch, a point in the map being marked; cross roads, owing to frequent shelling, are avoided, and the map is carefully studied, for no roadside posts or information will be available. The majority of aid-posts being off a usable waggon road, a sentry is stationed by the Regimental M.O. to guide the bearers at the nearest road point to the aid-post.

Each motor-ambulance carries two M.T., A.S.C. drivers, who should have been trained in driving in the dark, the roads covered are frequently pitted all over with shell holes, and very careful driving is required to avoid disaster.

On arrival at an aid-post, the M.O. ascertains the number and class of casualties requiring removal; the lying-down cases are removed first, and on the discipline and training of the bearers depends the rapidity with which the removal can be carried out. Having filled all the waggons, the first convoy to reach the agreed rendezvous leaves a bearer to notify the remaining convoy that all the waggons are full, and proceeds to the main dressing station. If a wagon is not filled, it remains at the rendezvous, to be at the disposal of the M.O., should he require it. After unloading at the main dressing station, a second trip may be required at once; in any case, the waggons will do the rounds again in time to be away from the neighbourhood of the trenches before daybreak.

When an attack has been delivered, the procedure is different; the waggons and bearers proceed to the advanced dressing stations nearest the sections of trenches attacking. Communication is established with Brigade Headquarters by cyclist or foot orderly, and the M.O. in charge will receive orders when the bearers should move up to collect. When orders to collect are received, the waggons move up, carrying the bearers to an already chosen point; the bearers remove their stretchers, and advance in file to communication trenches leading to fire trenches, where the majority of casualties are. It is found, in practice, that not more than two bearers can be spared to a stretcher, and many cases will require single-handed carrying—the easiest for patient,

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As a prophylactic measure, to prevent septic complications, and to do away with the essential elements of infection, the injured regions must be freed as quickly as possible of foreign bodies of every kind, which they contain, free splinters of bone, hæmatomata, and foul-smelling clots, whilst the wounds must be opened up freely. When possible, a radiograph should first be taken, for this will save useless or over-long gropings about in the tissues. The surgeon's gloved finger is still the most valuable and least harmful agent for exploration. Every fractured limb and every open joint must be immobilized, as soon as possible, in a splint of one kind or another.

The writers confine their remarks to the common infections, which constitute the large majority of the suppurations consequent to gunshot wounds. Most of these develop without noticeable reaction, and only give rise to pyrexia when the collections of pus, formed in the depths of the tissues, cannot discharge freely outwards. This short retention of pus very seldom leads to a rapid invasion of the organism by septicæmia.

Widespread septic pullulation, serious and frequently fatal bacterial dissemination chiefly spring from diffuse lymphangitis, suppurating wounds in the vicinity of large veins, which have become involved in the lesion, extensively comminuted fractures, and dirty wounds of the joints, more particularly those of large joints, like the hip and knee. Still, infected wounds of the finger-joints, alone, are quite sufficient to give rise to symptoms of general septicæmia. War injuries of the hand and foot call for careful and unremitting attention.

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NOTES ON BEARER WORK AT THE FRONT.

BY CAPTAIN HENRY W. SPAIGHT, R.A.M.C.

THE training in all branches of the Army has been altered in many particulars, during the past eighteen months, in order to meet the requirements of modern warfare. The work of the R.A.M.C. field-units has required a certain amount of modification from the excellent training laid down in the Training Manual, and some notes on the work of a field-ambulance bearer sub-section, gathered from actual experience in the field, may be of service to those engaged in training field-ambulance units at home.

Each section of a field-ambulance contains a bearer sub-division of 36 bearers, with four waggon orderlies in the case of "A" section, and three waggon orderlies in "B" and "C"; each bearer sub-division in charge of an M.O. with a sergeant. The ten ambulance waggons allotted to a field-ambulance consist of seven motor and three horsed waggons. These are allotted, three motor-ambulances to "A" section, two to "B" and "C," and one horsed ambulance to each section. The horsed ambulances are usually employed at the advanced dressing stations, established by the unit, and the motor ambulances only used for collecting from the aid-posts and trenches. The bearer sub-divisions are billeted, or bivouaced, in the neighbourhood of the main dressing station, where the ambulances are parked as well. Two bearer sections are used at a time, the third usually being held in reserve.

It is, as a rule, impossible for the bearers, with their ambulances, to approach the regimental aid-posts during the daylight, owing to shell fire; consequently, all collecting has to be done in the dark, and the training of bearers in stretcher and waggon drill in the dark is very important.

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reason of the negative pressure of the blood at the open ends of the veins. Wounds of the large trunks at the root of the neck are, in this respect, specially dangerous. The writers make reference to a case in which a fragment of shell was most carefully removed from the root of the neck, and one point of the fragment had penetrated a branch of the jugular. After doing well for four days symptoms of severe pyæmia developed on the fifth day, and rapidly proved fatal.

Operations anywhere near the big veins must be carried out with great caution, in order to avoid opening up any veins by which septic products may be aspirated into the circulation. Preliminary ligation of these veins above and below the wound should be performed whenever possible.

In the case of suppurating joints, with or without fractures of the bones, their serious nature is not hard to explain. Three causes chiefly bring about the spreading of the infection :—

- a. The difficulty of draining the synovial cavity, with its numerous *culs-de-sac*, so difficult of access, which often present a very extensive surface for absorption, as in the knee and the hip.
- b. The great absorbative power of the serous membranes for organisms and their products, which pass easily through the endothelium of the membrane, which, in the joints, is fairly quickly altered or destroyed. The absorption of these bacterial toxins puts a stop to phagocytosis taking place in the periarticular tissues, and the penetration of these toxins into the organism explains the pyrexia constantly attending suppurating joints.
- c. The very function of the joint, its mobility, itself promotes the continual inoculation of its surfaces and of adjacent wounds by preventing the formation of protective adhesions, which is, too, the reason why suppurating joints are not at all favourably disposed for cure.

The treatment of these affections consists in laying the joint freely open, as early as possible, then resecting the comminuted ends of the bones, and finally immobilizing the injured joint as completely as possible. In the dressing-stations, close to the firing line, the patient himself should be immobilized. It must not be forgotten that immobilization is not complete, unless the joints above and below the injured joint are included in the same plaster splint.

The main object of the writers in this article, however, is to deal with the methods of treatment in use for suppurating wounds of the soft parts. These wounds may be fistulous or fungating, with purulent sinuses coming from the deeper parts, or may even remain comparatively superficial.

When the suppuration is deeply seated, the cause must be removed as soon as possible by extracting any foreign bodies, by freely laying open collections of pus at their most dependent part, or by drainage, so arranged as to give effect to gravitation. Small multiple incisions, blind drainage-tubes, and drainage upwards are

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wounds with sterilized gauze, then with cotton-wool, and a bandage to keep all in place, then infrequent dressing is of greater value, for the dressings thus applied become adherent, more or less quickly to the granulations, irritate them, and injure them at every movement. When a fresh dressing is to be applied, the removal of the old one pulls away the tissues to which it is more or less fixed. In spite of the use of hydrogen peroxide, it is not possible to take away a dressing from an active wound without giving the patient great pain, destroying the delicate granulations, causing bleeding, and opening the door to infection. It is a method of barbarism, for, clearly, each dressing gives rise to fresh pain, infection, and injuries, all of which delay healing. These disadvantages must, accordingly, be put in the balance against the advantages of getting rid of the pus and cleaning the wound.

A consideration of these drawbacks led to an improvement of much importance in the treatment of granulating wounds by doing away with the harmful adherence of the dressings. After sundry experiments, begun with Carrel at the Hotel-Dieu, in Lyons, the authors arrived at a very simple solution of the difficulty. This consists in placing between the wound and the pieces of dressing some squares of thick muslin, of 2 mm. mesh, impregnated with vaseline, and sterilized at 120°. This allows all the exudations to pass through, and the dressing can be taken away with the greatest ease. The wound is left quite clean and free from pus and secretions, whilst the patient has suffered no pain, nor have the tissues been injured. By using this method, it has been found that much advantage is gained by frequent dressings of suppurating wounds, if healing is wished for as quickly as possible.

The important point is, that no injury shall be done to the wound at the time of dressing. Palpation, especially pressure on the neighbouring soft parts to expel pus, friction, and other manipulations promote inoculation of the tissues and the propagation of infection in the numerous lymphatic and vascular spaces of fresh granulations. Frequent dressings carried out according to the technique recommended will ensure the quickest and most economical healing. The only exceptions are suppurating joints and compound fractures, which should be disturbed as little as possible.

The next question concerns the advantages and the disadvantages of washing the wounds. When a fresh dressing is applied, it is useful to wash suppurating wounds, in order to clear away any pus adhering to the granulations, and to free the drainage tubes from clots or agglutinated secretion. For this purpose, use may be made of alcohol (60°), containing 1 part of iodine in 300 of alcohol, aqueous solution of iodine of the same strength, neutral peroxide of hydrogen solution, diluted to 3 or 4 volumes. Dakin's hypochlorite solution, isotonic saline, or hypotonic solution containing chloride of magnesium. In all cases, syringing forcibly into the deep tissues and in the drainage tubes must be avoided, more especially with peroxide of hydrogen solution. because the oxygen set free may open the aponeurotic interstices and the intermuscular spaces to the entry of germs carried along by

useless; they in no way bring about the flow of the septic fluids from above downwards. The pus must be followed up everywhere to its origin, and its free escape made certain by large openings and big tubes. Gauze wicks and sponges are not suitable, for, more often than not, they obstruct the openings which they should drain.

In the same way as foreign bodies, inflammatory affections of the bones, osteitis and osteomyelitis set up by long contact of the bone with septic products, are, through their sequestra and their area of superficial necrosis, the frequent cause of deep persistent suppurations and of never-ending fistulæ. Curetting these areas of constant inflammation of the bone, and removal of the splinters should not be omitted. As a rule, it is from the tenth to the fifteenth day after the wound that symptoms of post-traumatic osteomyelitis develop, and the temperature first begins its disconcerting rises.

Arising out of these remarks, the first question to answer is as to the suitability of using antiseptics for the treatment of suppurating wounds. In an earlier paper, the writers demonstrated, as the result of laboratory experiments and of a mass of clinical observations, that suppurating wounds heal more quickly when they are treated with appropriate antiseptics than when they are subjected, either to periodical or continuous flushings, or to impregnations with plain aseptic fluids. The conditions which antiseptics should fulfil were pointed out:—a microbicidal effect, as large as possible, with minimum toxicity, harmless to the tissues, and being quite as fatal to the bacteria as to the products of their decomposition.

It was pointed out, further, that out of many hundreds of different microbicidal agents tried, the *hypochlorites* combined these requisites in the highest degree. Lorrain Smith, Dakin, Carrel and others have proved this as well. The mixture of chloride of lime and boric acid, in the proportion of 1 to 3, which liberates hypochlorous acid slowly in contact with wounds, thus keeping up their disinfection for several hours, gave better results than all the other antiseptics.

Several writers have tried to condemn antiseptics on the ground that they lessen the defences of the organism by destroying the leucocytes, or that they are prone to produce alteration in the tissues, or to bring about local or general toxic symptoms. In the writers' judgement, these charges only apply to antiseptics badly chosen or improperly used.

The next question is:—whether frequent dressings are more suitable than infrequent? In spite of the advantages so long claimed for subcutaneous cicatrization, wounds are dressed, as a rule, to relieve them of pus, of septic products and scabs, or necrosed granulations lying on them. Maceration in pus has never appeared to the writers to be a condition which promotes healing, but rather the reverse.

Accordingly, but with due regard to the supply available, it would be proper to change the dressing frequently. However, if the usual ritual, in the treatment of wounds is adhered to, which is too much in favour, and which is more concerned with neatness of application than with surgery; that is to say, if it is thought suitable, every day, and, even by excessive zeal, twice a day, to cover up uniformly all

...uently, always preventing the dressing sticking to the surface means of vaseline-gauze; 5. Wounds, especially when granulating, ...t never be injured in the handling; and, 6. Wet dressings should ...be used exceptionally in particular cases, and must be changed ...uently, whilst maceration must be prevented.—(*Revue de Chirurgie*, ...ember, 1915.)

ECZEMA AS A COMPLICATION OF WOUNDS.

Louis Weiller draws attention to the secondary lesions of the ... that sometimes arise round the margins or in the vicinity of wounds under treatment. Usually, it is an eczema, which is ...re or less moist and much less frequently dry. These lesions ...velop, in those obviously predisposed to such attacks, as a result of an irritation of the skin, which may proceed from a variety of causes. In the first place, the secretion from the wounds, ...ecially when these are septic, may be the irritant. In these cases, if the dressings are not changed often enough, and particularly when moist dressings are used, the epidermis quickly becomes macerated, and the way is opened at once to secondary infections. The antiseptics used often cause irritation, which will disappear when simple aseptic methods are substituted. Washing the wounds may be carried out too freely, or baths used too long and too indiscriminately. In the early days of the War, a common practice was to immerse feet, legs, hands, or arms in a wooden tub containing a vague solution of permanganate of potash, if the wounds were considered to be suspect. Pressure by splints, whether of plaster or of metal, will set up irritation, and the resulting dermatitis readily spreads from the point of pressure to the wounds. One of the most usual causes is scratching by the patient, which is often done subconsciously to relieve the itching of a healing wound.

The attacks are often obstinate in character, and persist for some time after healing is complete. Sea-air, as a rule, does not promote the cure of these lesions, but is rather a hindrance. The treatment recommended by Weiller is a combination of hot-air douches and the application of ichthyol paste. He directs a douche of hot air, at a temperature of from 80° to 100°, over the affected area, which has previously been cleaned with a damp swab, well wrung out in sterile water. This dries the area quickly, and has some microbicidal effect as well. After two or three minutes, the following paste is applied over the whole area by means of a sterile swab held in forceps.

R	Ichthyolis	-	-	-	-	6
	Zinci Oxidi	-	-	-	-	40
	Paraffini mollis	-	-	-	-	100

The heat of the douche renders the application easy. The douche is continued for fully two minutes longer, and the part is then covered with a dry dressing.—(*Journal des Praticiens*, 8th July, 1916.)

the bubbles of gas.

Continuous irrigation by the drop method, recommended by Carrel, certainly yields brilliant results in the hands of its eminent introducer, particularly in wounds of the chest, in which infection has not, as yet, developed to any great extent. Unfortunately, this method requires constant watching, and strict asepsis in everything concerned with the patient. These conditions cannot always be secured in makeshift dressing stations, or even in many hospitals, in which the large numbers of wounded render constant individual attention to the patient and to the apparatus impossible to accomplish. When improperly carried out, the drop method may serve to diffuse infection.

For rugged, much suppurating wounds, threatening diffuse lymphangitis, such as arthritis, after resection of the wrist, hand, ankle, and foot, with infected synovial sheaths, the authors prefer, to the drop method, a daily bath, lasting one hour, with dry or slightly moist dressings in the interval.

With regard to dry or wet dressings, the dry are preferred, as a rule, because they can be sterilized more effectually, and do not risk bringing to the wound the microbes contained in doubtful pieces of dressing, or scattered on the insufficiently disinfected skin. Moreover, a serious drawback of moist dressings is the maceration of the skin, especially when they are under an impermeable covering. During the last year, disastrous effects have been caused to nearly all the wounded, who arrived at Lyons, after a journey of thirty-six hours from the front, with their dressings covered with rubber tissue. Many cases of lymphangitis, suppurating joints, and amputations would have been avoided with a different kind of first-dressing. When much pus is poured out, it is not absorbed by the dressing, but stagnates and impregnates the healthy tissues, promoting the development of new foci of suppuration and pyodermitis.

Moist dressings, however, with all the aseptic substitutes for the old-time poultice, can be of much service in the case of deep lying inflammation, painful indurations, and the extensive superficial lymphangitis and gangrenous suppuration of the limbs, following incision for abscess in the synovial sheaths of the hand or foot. When a wet dressing has a covering of gutta-percha tissue, or the like, it must never be left in place for longer than twenty-four hours, so that the condition of the skin may be observed, and the skin itself given a respite by exposure to air under a simple covering of gauze.

The authors summarize these elementary remarks on the treatment of suppurating wounds thus:—

1. The wounds must be relieved as quickly as possible of foreign bodies, projectiles, shreds of clothing, and so forth—and of any loose splinters present;
2. The infected tracks and collections of pus must be drained as early as possible, by free incisions and by drainage-tubes running through and leading out at the most dependent point;
3. The antiseptic treatment of wounds should be adopted, use being made, preferably, of the hypochlorites, and mainly of the mixture of chloride of lime and boric acid;
4. The wounds should be dressed

Protozoa and Disease. Part IV. Rhizopod Protozoa. By J. JACKSON CLARKE, M.B., F.R.C.S. Pp. 187. London: Baillière, Tindall and Cox.

It is refreshing to find a man, who devotes himself largely to clinical work, writing a book upon one of the purely scientific branches of medicine. A greater combination between clinical and scientific work would help to narrow that wide gulf, which now separates these two divisions of medicine. The author has put a great deal of work into this volume, the essence of which is that cancer is caused by protozoa. Observers have noticed that the nuclei and nucleoli of the host's cells sometimes undergo a process of division like protozoa. The author considers that these are protozoa, and not nuclei and nucleoli which are behaving parasitically. This question, to our mind, could easily be settled if the material was stained with dyes, the exact microchemical action of which is known. Unfortunately, the author has relied mainly upon hæmatoxylin, perhaps the one stain concerning the action of which we are entirely in the dark. If the author could find time to make a microchemical investigation of the cancer cells he portrays, an extremely valuable addition to the ætiology of malignant disease would follow therefrom. This is a volume which should certainly be read, even by those who are most antagonistic to the views expressed.

The Operations of Surgery (Jacobson). By R. P. ROWLANDS, M.S., F.R.C.S., and PHILIP TURNER, B.Sc., M.S., F.R.C.S. Sixth edition. Vol. I. Pp. 1,008. Vol. II. Pp. 914. London: J. and A. Churchill. Price £2 10s.

It may truthfully be said that a new edition of Jacobson was awaited, by those of us who have known the book from our earliest student days, with a certain amount of dread, lest the authors, in bringing it up to date, should make alteration in the scheme originated by the master himself; happily, within the sixth edition, nothing of the kind has been done. Without unduly padding the work, a great deal has been added and a great deal withdrawn, both with much advantage. Mr. Philip Turner's work on the head and neck, chest and upper extremity is exceedingly good. It is clearly and carefully planned, and will be of the utmost utility to those interested in special work in these regions. Mr. G. Bellingham Smith is responsible for the revision and partial re-writing of the operations on the ovary and uterus. He has carried out his task with the utmost care to a most successful issue.

The authors acknowledge assistance from a long list of world-wide surgeons, each of them the most eminent in his branch, and it is clear no pains have been spared to incorporate the very latest work culled from the workers direct.

It may be said at once the improvement in the quality and variety of the illustrations is most welcome. Those of the relationship of arteries are most beautifully and delicately coloured, and reflect the greatest credit both upon the artist and the publisher. Certain of

Reviews of Books.

Diseases of the Nose and Throat. By Sir ST. CLAIR THOMSON, M.D., F.R.C.P., F.R.C.S. Second edition. Pp. 858 + xvi, with 22 plates and 337 figures in the text. London: Cassell and Co., Ltd. 25s. net.

It is more than four years since the first edition of Sir St. Clair Thomson's textbook was published, and the progress of rhinology has made continued and steady progress. Without changing its main design, the work has undergone a complete and rigorous revision, and a good and clear description of suspension-laryngoscopy has been included. A book that is based on personal experience is always valuable, especially when that experience is compared and assisted by the work of others. Many modern textbook authors are fond of drawing upon the brains of others without due—often without any—acknowledgement, pretending that it would be invidious to single out other workers, a subterfuge easily seen through. The author of the work under review is above this kind of writing, and accords to other observers full credit for their labours. Hence the book is of greater value as a textbook than others of its kind. An adequate review would require far more space than we can command, and it is difficult to single out for special praise any one portion. It is well arranged, clearly and lucidly written. The illustrations, especially the coloured plates, are singularly excellent. The work, taken as a whole, is one which reflects great credit upon its author, and must considerably enhance his already established reputation. It is one that can be read with advantage alike by general practitioner, specialist, and student.

Handbook of Physiology. By W. D. HALLIBURTON, M.D., F.R.S., Professor of Physiology, King's College, London. Twelfth edition. Pp. xix and 924. London: John Murray. 15s. net.

THE appearance of a new edition of Professor Halliburton's well-known "Handbook" after so short an interval (two years) is evidence of the esteem in which it is held by students. The alterations made in the present edition are of a minor character, and are only such as are necessary for bringing the book up to date. One of the features of the book has always been the bringing into prominence of the bearing of physiological facts on clinical practice, and this has been well maintained in the present edition. Thus we have an account of Schafer's method of artificial respiration, the phenomena of heart-block, pathological urine, etc., though we think more details might have been given of Professor Leonard Hill's investigations on ventilation.

The chemistry and physics of the body are dealt with admirably. We predict that the present edition will prove as popular as its predecessors.

the original drawings are still retained, and one would be very sorry to see them go. They serve to remind one of one's "old days," and they make one sometimes wonder whether the student of to-day has not, in the new coloured pictures, a more keen incentive to dwell upon his books!

The second volume is devoted to the abdomen, and if one would quibble at all, it would be in respect to this portion of the book. Crile's wonderful work on anoci-association truly receives passing attention in Volume I. Nothing is said about its value, and yet, in connection with the abdomen, it is probable that the principle of anoci-association is of vast importance: the mental as well as the physical preparation for operation, the importance of local trauma in the practice of the operation can never be sufficiently emphasized, for, in anoci-association (as a principle); lies the secret of successful abdominal work.

Can it still be a fact, that surgeons use habitually the appendicectomy incision depicted on page 2, Vol. II.? Except for an appendix abscess pointing at this spot, surely the Battle's incision or the incision through the right rectus is the better one. Extension of the incision indicated is surely fraught with lasting muscular damage, whilst the field given for exploration of the stomach, gall-bladder and pelvis is very restricted. Iodine is recommended as a preparation for the skin of the abdomen. Has it been proved that iodine is more successful than any other antiseptic? It is true it colours the skin and is easily applied, but surely the old principles of scrupulous cleanliness achieved by soap spirit, followed by an alcoholic antiseptic, might have honourable mention! Gastric surgery is well done. Advantage has been taken of the latest work done, and the illustrations are exceedingly good. The statistics given are out of date.

It may generally be said that the sections on intestinal surgery and the surgery of the gall-bladder are excellent, with the exception that too much space is devoted in the former to such an effete apparatus as the Murphy button, whilst the recommendation, shown in Fig 219B, to fix the gall-bladder to the abdominal wall is often impossible of achievement, and, in any event, is mischievous as well as unnecessary.

Only praise can be given to the urogenital work in all its sections.

As a whole, the book very worthily maintains and even enhances the reputation of the old edition, and it is quite certain that it remains the very best work of its kind in the British language.

Practical Prescribing and Treatment in the Diseases of Infants and Children. By D. M. MACDONALD, M.D. Pp. 199. London: Frowde, Hodder and Stoughton.

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THE MEDICAL TREATMENT OF CANCER—(Continued)

CONCLUSIONS (continued).

specificity); this pain is characteristic, and typical in nearly all the patients. Afterwards, either they no longer increase in size, and then present the characteristics of benign tumours, or else they begin to retrogress, retrogression of possibly the third, the half, two-thirds, or even the whole. In the last condition nothing remains to show that the organism has ever been diseased.

B.—GENERAL PHENOMENA.

The following facts may be considered as being practically established:—

(a) *Return of the appetite*, which may be insatiable, and steady increase of weight, often very great.

(b) *Return of the colour and strength*, the capacity for life's occupations: patients "gain a new lease of life."

(c) *The disappearance of pain*. Cuprase exerts a powerful analgesic action and under its influence the violent pains, which had resisted the effect of large doses of morphine or which the morphine had only relieved in a very imperfect manner, have rapidly disappeared, never again to return.

(d) *Return of sleep*. This is a consequence of the disappearance of the pain.

12. *Hæmostatic action*. This action sometimes rapid is apparent from the first injection, even when the classical methods have failed.

13. *Action upon the blood*. Under the influence of Cuprase the number of red corpuscles is greatly increased, as well as their richness in hæmoglobin.

each ampoule contains 121 hundredths of a milligramme—viz., 0.00121 gm. of pure copper. The colloidal copper can be directly injected, it is not toxic; the injections are made subcutaneously or intramuscularly in the lumbar region or lower. They are painless; but on account of the viscosity of the liquid should be performed slowly. They are not generally followed by any reaction, either local or general; sometimes when a drop of blood appears on the skin after the needle is withdrawn; in the 24 hours following the injection a painless erythema followed by slight itching is observed above and around the puncture; this accident, which is insignificant, may easily be avoided by puncturing with the needle only, before injection; if no blood appears on the needle socket the injection may be proceeded with safely. The injections are renewed every four days at the commencement of the treatment: the intervals can afterwards be increased or continued in the same manner, according to the tolerance of the patient, or even doubled if the condition of the patient requires it, but not more than one ampoule should be injected in the same place.

The curative action of the colloid would seem to be slower on the operable and recurrent cancers than on the inoperable. Nevertheless, the curative action of the colloid is as marked on the recurrent cancers, but is slower on account of the extent of the disease, which is greater in surface and in depth. Every cancer left to itself ends in a rodent ulcer. Under the influence of the colloid this ulcer gradually shrinks from its circumference towards the centre in proportion as the cancerous tissue surrounding the ulcer disappears; the ulcer dries up in the centre, but it is not healed until the peri-cancerous and cancerous tissue itself has disappeared. The secondary infections which so often accompany the cancerous ulcers are not affected, or very little so, by the colloid, but I have observed that from the commencement of the treatment of the ulcerated cancer by the colloid the cases of secondary infections became more and more rare.

The intensity of the destructive action of the colloidal copper on non-ulcerated cancer appears to be in direct proportion to the rapidity of its development; that is to say, the colloidal copper is more effective in its action upon cancers with rapid development than upon those of slow development, or rather, acute cancers heal more quickly than chronic ones, if one may so express it.

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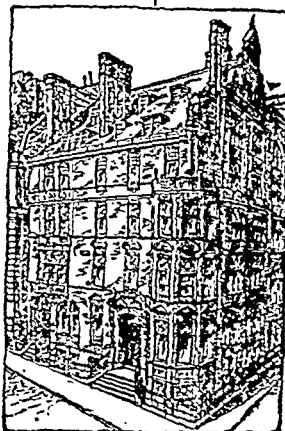
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AUGUST, 1916.

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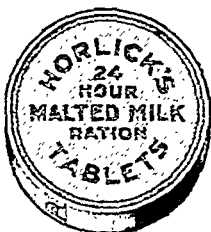
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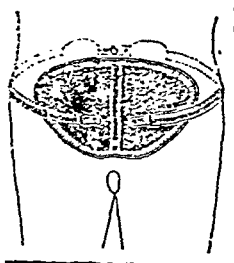
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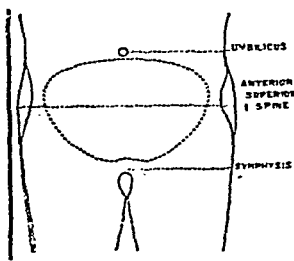


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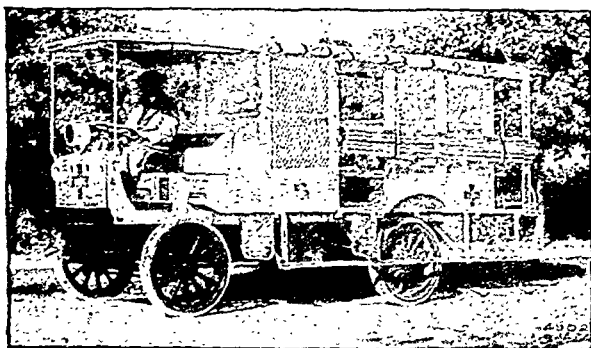
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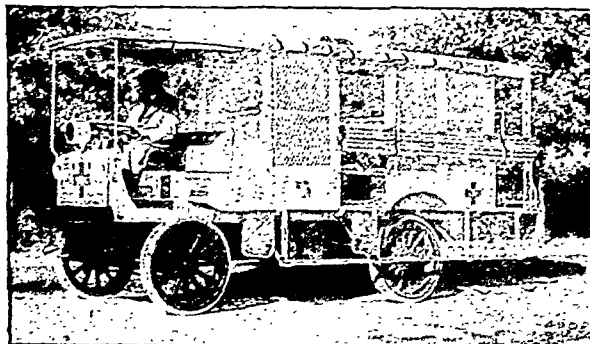
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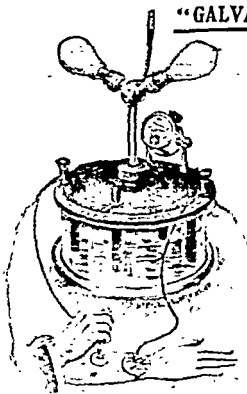
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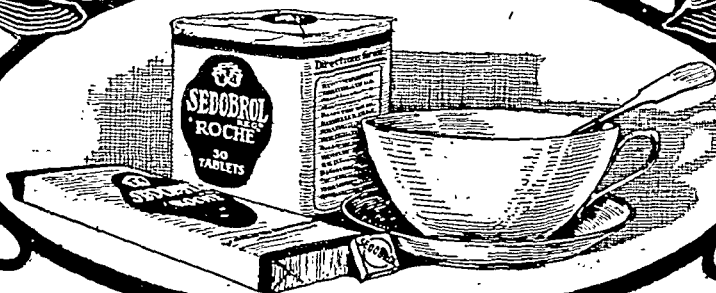


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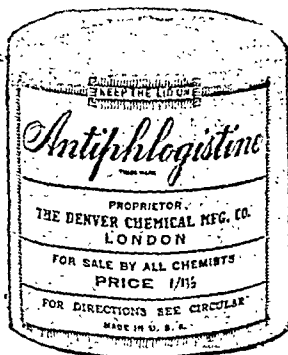
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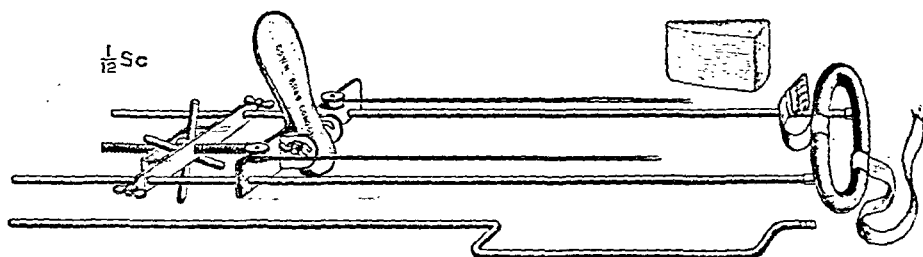
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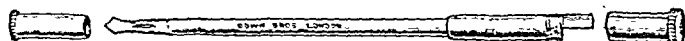
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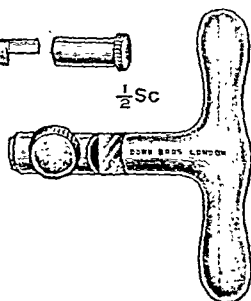
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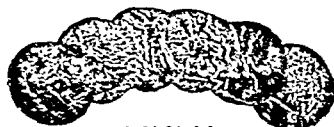


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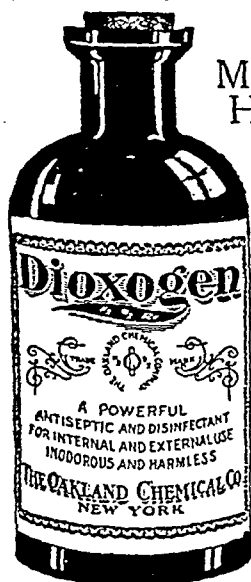
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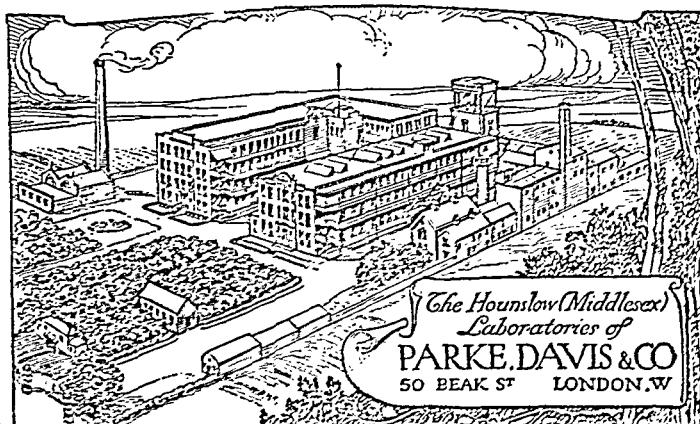
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"I prepared the tinctures from Parke, Davis & Co.'s fluid extracts made up to the proper strength with glycerin and chloroform water. In this way the use of alcohol, undesirable in kidney cases, is avoided. The prepara-

tion of fresh infusions advised by some writers is impossible for the busy practitioner, and I have never had any cause to complain of the digitalis prepared as above.

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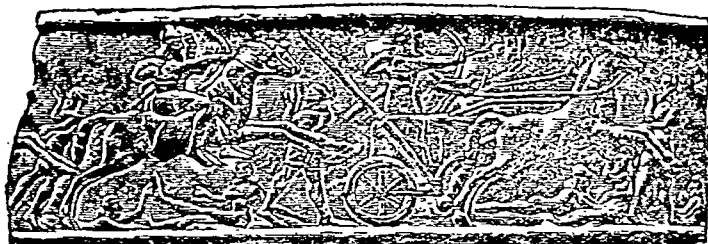
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Assyrian monumental bronze, from the gate posts of a Royal Palace, illustrating a campaign in Syria. The fragment reproduced portrays in relief Assyrian archers, mounted as cavalry, and in chariots, shooting down enemy warriors at the gallop. Date, circa 854 B.C.

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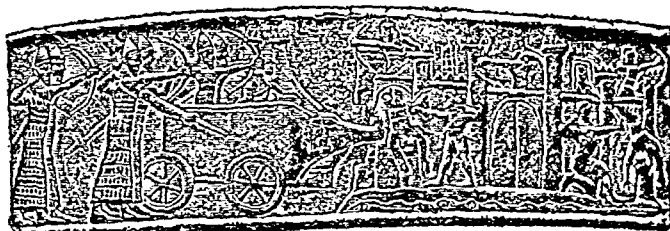
IN the production of this Serum a large number of cultures representing all the various types of meningococci and parameningococci, obtained during recent epidemics in England and Europe, have been used. The Serum contains a high anti-body titre when tested against all the recognised types.

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Assyrian siege-warfare, of a period contemporaneous with Ahab, King of Israel. The walls of an enemy city are being breached with a great battering-ram, behind which are Assyrian archers, covering the attack. Slain defenders are seen falling headlong from the city walls. Date, circa 854 B.C.

THE PRACTITIONER.

AUGUST, 1916.

A NEW METHOD OF BLOODLESS CIRCUMCISION.

By HENRY CURTIS, B.S., F.R.C.S.

*Surgeon to the Metropolitan Hospital, N.E., and to the Enfield Road
Military Hospital, N.E.; Formerly Teacher of Operative
Surgery, London School of Clinical Medicine,
Dreadnought Hospital, Greenwich.*

THE wonderful fertility of the Hebrew nation, in spite of complete circumcision, and the undoubted moral and hygienic value of this little operation are arguments which entirely counterbalance the somewhat sentimental objections recently raised against it, once more, by some surgeons of repute. As to the alternative proposed by objectors, namely, the stretching of the phimosis, contraction is very liable to recur, and, at best, this treatment does not do away with the moral and hygienic difficulties. In addition, practitioners of experience will, doubtless, have met cases in which, though complete retraction is possible in the quiescent state, congestion, and—still worse—infective inflammation, reveals the presence of a degree of phimosis unsuspected previously. In either of these circumstances, it constitutes a manifest handicap and a source of complaint. Should infection occur, the stenosis increases, and entails serious locking-up of the discharge. The increased virulence of the resulting infection not infrequently leads to severe phagadænic ulceration and considerable or even total sloughing of the glans, not to speak of grave infection of the prostate, vesiculæ, joints, fasciæ, and the body generally. The advantages of circumcision are, indeed, so obvious that, in the opinion of the present writer, it should be done at birth, as a routine, in the case of every male child.

The operation as usually performed, however, may, and often does, entail an unnecessary loss of blood, or the formation of a troublesome hæmatoma. The neglect to secure

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Acute or Chronic.**

A Few Clinical Results.

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We deem it our duty to draw attention to this action of **Colloidal Iodine**, since it brings about a rapid and certain cure in gonorrhœa and causes a disappearance of the gonococci, without in any way interfering with the integrity of the organs.

DRS. MIETTE and TRUFFIER.

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It has seemed to us of some interest to report this case on account of the result obtained, and above all on account of the means employed for attaining it, for follicular abscesses of gonorrhœal origin, however they may start, always sooner or later acquire chronic symptoms, and we have never so far seen any but surgical treatment leading to a certain cure.

The success which has attended our urethral dressings with **Colloidal Iodine** seems to give some promise that the necessity for the radical methods of surgical treatment in cases of urethral folliculitis of gonorrhœal origin may be somewhat reduced.

By MARCEL DESCHAMPS, late House Physician, Assistant to Dr. Bazy, of the "Hôpital Beaugon," and JEAN PERRIGAULT, late House Physician of the Infirmerie Centrale des Prisons.

Chronic Urethritis. Subacute Urethritis. Very Acute Urethritis.

We are therefore justified in concluding that **Colloidal Iodine** should be accorded front rank, among anti-gonorrhœal agents, as much on account of the value and rapidity of its action as on account of its absolute harmlessness which allows us to administer it without the slightest fear of any complication arising owing to its use.

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1. IT IS A URINARY ANTISEPTIC;
2. A SOLVENT OF URIC ACID AND OF PHOSPHATES;
3. A MILD NON-TOXIC DIURETIC.

NOTE THE FOLLOWING POINTS:

1. The **Benzoic acid** and the **Benzoates** are transformed in the system into hippuric acid and consequently make the urine acid, which is necessary when the latter is alkaline and ammoniacal;

2. Moreover this acid medium is indispensable for the cleavage of the **Urotropine** (Hexamethylenetetramine) which thus furnishes a certain quantity of Formol, the bacteria-destroying properties of which are well known;

3. **Helmitol** (anhydro-methylen, citrate of Hexamethylenetetramine) possesses not only the property of disinfecting urinary apparatus to a greater extent than Urotropine, but it also possesses sedative anæsthetic properties of utmost value in painful affections;

4. Lastly the **Piperazine** (diethylene diamine) will cause the rapid elimination of uric acid and urates in the form of soluble compounds.

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and adults alike.

To proceed to the immediate subject of discussion, *Bloodless Circumcision*, the method devised by the writer, and found to be most satisfactory in practice, is as follows:—

Technique.—On either side of the median dorsal line, the prepuce is seized between two pairs of Spencer-Wells' forceps (Fig. 1, c_1 , c_2), the points of which are pushed right up to the level of the corona glandis. Possibly, in an adult, large Wells' forceps, or more than one pair of the smaller clips, may be required on each side to reach thus far.

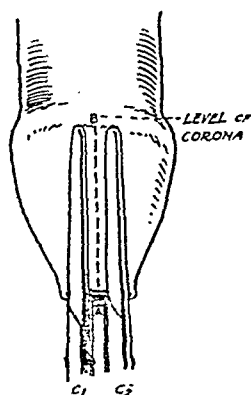


FIG. 1.

FIG. 1.—*Bloodless circumcision, c_1 , c_2 , first pairs of clamps, between which the median dorsal line, A, B, of the prepuce is divided.*

The median line (A, B) of the prepuce between the clamps, as one may henceforth term them, is slit up to the corona, with scissors, taking care, of course, to avoid wounding the glans, or urethra, which may easily be done if, as is not infrequently the case, there is marked phimosis, and, in adults especially, more or less firm and extensive adhesions from balanoposthitis, from retained and inspissated smegma, or other infective sources of irritation.

The result of the slit thus made is to divide the prepuce into two lateral flaps (Fig. 2), each of which is first carefully separated right up to the groove behind the corona, all round, so as to evacuate inspissated smegma, and then clamped, from below upwards, at a distance of about $\frac{1}{8}$ th inch from its

each bleeding-point at the operation, and to make sure that there is no oozing subsequently, at the time when the patient is left, or is sent home, must be held accountable for that small but regular percentage of deaths from hæmorrhage which is reported annually.

The common errors in performing circumcision depend on :—

- (i) trimming the prepuce down to, and including, the frænum, resulting in frænal hæmorrhage; or, in anxiety to avoid this,
- (ii) leaving too much tissue in the region of the frænum, which results in the formation of an unsightly "blob," which, though it eventually shrinks down as the œdema passes off, is very distressing, meanwhile, to the parents.

Hæmorrhage from the frænal vessels is easily controlled by a mattress-suture, the needle being passed so as to include the bleeding-point, and the suture tied on the skin just below the frænum, a method equally applicable to bleeding elsewhere. Throughout the operation, of course, catgut sutures (and ligatures, if required) should be used. They dissolve in due course, avoiding the necessity, otherwise, of an inevitably painful removal.

Both hæmorrhage and "blob" are, however, better avoided by not cutting as far as the frænum, leaving a margin of not more than $\frac{1}{8}$ th inch on either side of the raphé. As Corner has pointed out, the "blob" is caused by leaving too much tissue in this region.

As to the amount of prepuce to be left after circumcision, a margin of not more than $\frac{1}{8}$ th inch of mucous membrane should be retained for suturing to the skin. As to the amount of skin, the common practice of dividing it at the level of the corona glandis appears to be without objection; though, especially in the case of adults, some surgeons, with a view to preserving greater sensitiveness, as it is thought, prefer to leave sufficient integument to cover the proximal third of the glans.

Arguing from the Jewish practice, and the view expressed in the opening paragraph of this article, complete circumcision seems perhaps, on the whole, the better operation for infants

and adults alike.

To proceed to the immediate subject of discussion, *Bloodless Circumcision*, the method devised by the writer, and found to be most satisfactory in practice, is as follows:—

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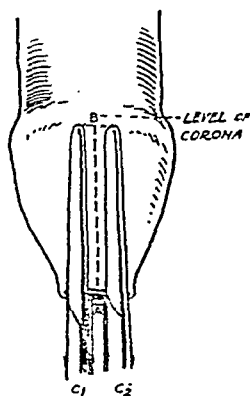


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HYPERALGESIA IN ABDOMINAL DISEASE.

PRELIMINARY NOTES ON THE DIAGNOSTIC VALUE OF MAXIMAL POINTS
OF HYPERALGESIA OF THE SKIN AND SUBCUTANEOUS
TISSUE OF THE ABDOMINAL WALL IN AFFECTIONS
OF THE ABDOMINAL VISCERA.

By DAVID LIGAT, F.R.C.S.

Acting Assistant Surgeon, Middlesex Hospital.

In the past 25 years, a considerable mass of literature has accumulated on the subject of visceral pain, and to-day divergent views exist as to the precise significance of this symptom. That a viscus can give rise to pain admits of no doubt.

Broadly speaking, three theories have been put forward with regard to its nature:—

- (1) Mackenzie suggested, in 1891, that no viscus could appreciate pain as such, but that all so-called visceral pain was really pain referred to and felt in some area of the body wall.
- (2) Head¹ and his co-workers, Rivers and Sherren, consider that a viscus is possessed of protopathic sensation.
- (3) Hertz² is of opinion that a viscus does feel pain as such, and that the only true cause of visceral pain is increased tension.

I do not propose to enter into a discussion regarding the arguments for or against any of these theories, for that would be foreign to the object of this paper. But it will be seen, from the general trend of the notes to follow, that all the pain that a patient complains of, and the tenderness that an observer can elicit, would seem to be due to a true *viscero-sensory reflex*, and not in any way to pain or tenderness felt in the organ itself.

Afferent impulses from all the viscera are constantly passing to the spinal cord, whence reflex efferent messages are as constantly transmitted to the tissues of the body-wall

(muscles, interstitial tissues, and skin).

We are dependent on these correlated impulses for the efficient discharge of our normal physiological functions—respiration, digestion, etc.—and in health are quite unaware of their existence.

But when an organ or part of an organ becomes irritated or inflamed, more urgent afferent impulses than normal ascend to the group of cells in the spinal cord, which is in direct nerve communication with the affected organ, and, this group of cells, being subjected to undue stimulation, forms an *irritable focus* in the spinal cord.

The equilibrium of the viscero-sensory arc is thus disturbed, and a stimulus, which applied to the corresponding cutaneous surface of the body wall would have given rise to a normal sensory response in health, now gives rise to an abnormal one. In other words, a pinch which, in a person with a spinal cord of normal tone, would not have given rise to pain, now does so, on account of the stimulus due to the pinch being received by a part of the cord, which is being kept in an irritable condition by undue stimuli from a diseased viscus.

A distinguished surgeon has said that pain is the most fallacious of all abdominal symptoms, but I hope to show, as a result of the investigations noted below, that pain can be harnessed for our use, and that, by careful examination and discrimination of the areas in which spontaneous and, more especially, elicited pain, are felt, definite progress may be made towards an accurate diagnosis.

Sir James Mackenzie, in *Symptoms and their Interpretation*, has laid down generally the lines on which the following investigations were conducted, and the result has been, on the whole, a striking confirmation of the views he then stated.

When I first became interested in this method of examination, I tried various methods of eliciting reflex responses—stroking the skin with cotton wool, running the smooth end of a glass rod against the skin, stroking the skin with the point of a needle, pricking the skin with a needle, and so on. The results obtained were interesting but inconstant. I now employ a different method, which yields results definite and demonstrative. I grasp the skin and subcutaneous tissue firmly between finger and thumb, and draw them away from the

HYPERALGESIA IN ABDOMINAL DISEASE.

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TISSUE OF THE ABDOMINAL WALL IN AFFECTIONS
OF THE ABDOMINAL VISCERA.

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IN the past 25 years, a considerable mass of literature has accumulated on the subject of visceral pain, and to-day divergent views exist as to the precise significance of this symptom. That a viscus can give rise to pain admits of no doubt.

Broadly speaking, three theories have been put forward with regard to its nature:—

- (1) Mackenzie suggested, in 1891, that no viscus could appreciate pain as such, but that all so-called visceral pain was really pain referred to and felt in some area of the body wall.
- (2) Head¹ and his co-workers, Rivers and Sherren, consider that a viscus is possessed of protopathic sensation.
- (3) Hertz² is of opinion that a viscus does feel pain as such, and that the only true cause of visceral pain is increased tension.

I do not propose to enter into a discussion regarding the arguments for or against any of these theories, for that would be foreign to the object of this paper. But it will be seen, from the general trend of the notes to follow, that all the pain that a patient complains of, and the tenderness that an observer can elicit, would seem to be due to a true *viscero-sensory reflex*, and not in any way to pain or tenderness felt in the organ itself.

Afferent impulses from all the viscera are constantly passing to the spinal cord, whence reflex efferent messages are as constantly transmitted to the tissues of the body-wall

(muscles, interstitial tissues, and skin).

We are dependent on these correlated impulses for the efficient discharge of our normal physiological functions—respiration, digestion, etc.—and in health are quite unaware of their existence.

But when an organ or part of an organ becomes irritated or inflamed, more urgent afferent impulses than normal ascend to the group of cells in the spinal cord, which is in direct nerve communication with the affected organ, and, this group of cells, being subjected to undue stimulation, forms an *irritable focus* in the spinal cord.

The equilibrium of the viscero-sensory arc is thus disturbed, and a stimulus, which applied to the corresponding cutaneous surface of the body wall would have given rise to a normal sensory response in health, now gives rise to an abnormal one. In other words, a pinch which, in a person with a spinal cord of normal tone, would not have given rise to pain, now does so, on account of the stimulus due to the pinch being received by a part of the cord, which is being kept in an irritable condition by undue stimuli from a diseased viscus.

A distinguished surgeon has said that pain is the most fallacious of all abdominal symptoms, but I hope to show, as a result of the investigations noted below, that pain can be harnessed for our use, and that, by careful examination and discrimination of the areas in which spontaneous and, more especially, elicited pain, are felt, definite progress may be made towards an accurate diagnosis.

Sir James Mackenzie, in *Symptoms and their Interpretation*, has laid down generally the lines on which the following investigations were conducted, and the result has been, on the whole, a striking confirmation of the views he then stated.

When I first became interested in this method of examination, I tried various methods of eliciting reflex responses—stroking the skin with cotton wool, running the smooth end of a glass rod against the skin, stroking the skin with the point of a needle, pricking the skin with a needle, and so on. The results obtained were interesting but inconstant. I now employ a different method, which yields results definite and demonstrative. I grasp the skin and subcutaneous tissue firmly between finger and thumb, and draw them away from the

deeper layers of the abdominal wall. If an hyperalgesic area be present, the patient winces, and one can tell, by the patient's expression, when such an area is being stimulated.

At first the attempt was made to define the area of skin, which had been rendered hyperalgesic in any given case, on the basis of corresponding segmental areas, and so to deduce the organ affected. But I soon found that the hyperalgesia was not present uniformly over any segmental area, but that it spread from one part of a segment to another segment in a particular way, without having affected any one whole segment.

Actual points were noted, roughly, about the size of a shilling laid on the skin's surface, the pinching of which caused pain out of all proportion to the pain produced by the same methods applied to the skin and subcutaneous tissue very near to these points and in the same segmental area. One was forced to the conclusion that these points corresponded anatomically with the subcutaneous distribution of certain branches of particular nerves.

The amount of pain produced varies widely. Usually, when there is abundant presumptive general evidence of acute inflammation of a viscus, the pain produced by pinching is acute, and can be elicited over a large area of skin; this area perhaps corresponds to parts of two or even three spinal segments, but by careful discrimination of the point of maximum hyperalgesia, the actual organ affected can be decided on in most cases. In other cases, in many of which the patient has only been complaining of vague abdominal pain, very careful examination is necessary, the facial expression of the patient being closely watched when the skin is pinched. It is in these cases that this method of examination is so valuable, for by so examining one is converting a subjective symptom virtually into an objective sign. In a considerable number of cases, the patient has hardly admitted that the pinch has caused actual pain, the sensation produced being evidently difficult to define, but described as "curious," "unpleasant," "different to the other place," and so on. In all positive cases, a departure from normal sensation is evident.

One must always be on one's guard against the neurotic patient, especially in chronic cases, who may complain of pain when pinched at the maximum point of an organ, but

usually some other feature of the case, when viewed as a whole, comes to one's aid, or atypical spread may be present to help one to come to a decision. Occasionally, however, the simulation is very exact, and may constitute a real difficulty.

In this method of examination, the following points should be noted:—

(1) The patient should be made to appreciate a pinch of definite pressure over a normal point and asked to realize the sensation, the facial expression being watched closely at the same time, for normal sensation to pinch varies widely in different individuals.

(2) An exactly similar pinch is applied at the spot where the maximum response is expected. No downward pressure is made on the abdominal wall, but the skin and subcutaneous tissue are picked up from the abdominal wall and pinched with the same amount of force that had been applied in the control.

(3) The direction and limitation of the extension of the hyperalgesia must be carefully noted.

In an acute case, inspection has probably revealed a certain area of abdominal wall as relatively motionless on respiration. Somewhere in this area one expects to find a maximum point of hyperalgesia, but it probably includes two, and may easily include three. One now picks up and pinches the skin and subcutaneous tissue at a point on the other side of the abdomen, and where a normal response is expected ; for instance, if the abdominal wall over the right iliac region shows diminished movement on respiration, one would naturally expect an acute appendix. The maximum appendix point is situated at the junction of the upper and middle thirds of a line drawn from the umbilicus to the right anterior superior spine, at which point certain twigs of the eleventh dorsal nerve have become subcutaneous, and can be picked up between the fingers and included in the tissue pinched. This is McBurney's point, which has long been known to be tender on pressure in acute appendicitis. In examining the abdomen, one therefore picks up and pinches the precise corresponding point on the left side, at the same time asking the patient to appreciate the sensation produced. This is immediately followed by pinching the same point on the suspected side. Presuming the result

is markedly positive, we have now to determine whether this is the most hyperalgesic point in the area; if it is, and the spread is typical, a definite diagnosis of appendicitis may justifiably be made. In this area, in the female, there is one more definite point corresponding to a particular organ, that is, to the right Fallopian tube. This point is situated at the junction of the lowest and adjacent fourths of a line drawn from the middle of Poupart's ligament to the umbilicus, at which point some twigs of the twelfth dorsal nerve become subcutaneous.

In many cases of acute appendicitis, hyperalgesia is elicited at this point too, but it is never so marked as at the true appendix point. On the other hand, in affections of the right tube, the appendix point is less often hyperalgesic, perhaps because the afferent stimulus from the tube to the spinal cells is usually less strong than that from an acute appendix. This may be true only as regards personal experience, for I have seen many more cases of acute appendicitis than of acute tubal disease; but I have noticed that hyperalgesia tends to spread to a greater distance below than above any maximum point.

At this stage, to prevent future repetition, it will be convenient to discuss more fully the situation, spread, and limitation of hyperalgesia.

Speaking generally, when a patient is suffering from a very acute attack of biliary or renal colic, or from a perforating gastric ulcer or appendix, the pain is so great, and the hyperalgesia may be so severe and widespread, that little as to its usual characteristics can be made out.

It is in the less acute, or even in the chronic cases, that the hyperalgesia may best be studied, and the facts regarding the maximum point, spread and limitation, best elicited.

When *one* organ is affected, careful examination will reveal the following facts:—

(1) One maximum point.

(2) Spread from this point in a vertical direction, the hyperalgesia usually spreading further in a downward than an upward direction.

(3) Little, if any, lateral spread in either direction.

Cases which may show considerable vertical spread, show

no lateral spread at all. This fact is of great value in assisting diagnosis as between one of the lateral organs (gall bladder, appendix, and tube) and one of the central organs (stomach, duodenum, small and great gut).

To take the gall-bladder first. The maximum point is situated where a horizontal line drawn from the tip of the tenth rib crosses a vertical line drawn midway between the nipple-line and the middle line of the abdomen. Mackenzie noted this point in 1891.

Out of 54 cases of cholecystitis, in the great majority of which gallstones were present, and all of which were operated on and verified, 41 cases gave a marked hyperalgesia at the above point. Most showed some vertical spread downwards, which, in a few cases, overlapped the appendix point. Lateral spread in either direction was conspicuous by its absence. In no case, in which the lesion was confined to the gall-bladder, had hyperalgesia to pinch reached the middle line. The two cases in which hyperalgesia had extended to the mid-line turned out to have stones, not only in the gall-bladder but, in one case, in the common duct, and, in the other, at the junction of the cystic and common ducts; in both cases, jaundice was present, proving implication of the mucous lining of the common duct.

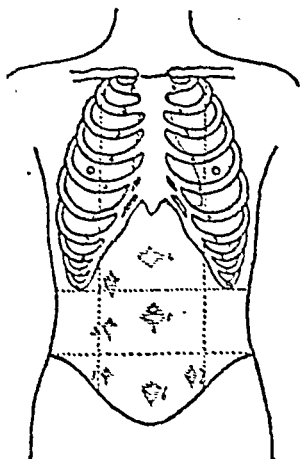


FIG. 1.—Diagrammatic illustration of the hyperalgesic points, with typical spread. The length of the line denotes the intensity of the hyperalgesia, not lateral spread. Note there is more downward than upward spread.

1. Shows hyperalgesic area when present in gall-bladder lesions.
2. Shows hyperalgesic area when present in appendix lesions.
3. Shows hyperalgesic area when present in right Fallopian tube lesions.
4. Shows hyperalgesic area when present in gastric and duodenal ulcers.
5. Shows hyperalgesic area when present in small-gut lesions.
6. Shows hyperalgesic area when present in great-gut lesions.
7. Shows hyperalgesic area when present in left Fallopian tube lesions.

In 243 consecutive cases of appendicitis, 195 gave definite

hyperalgesia to pinch at the maximum point, which has already been noted, and which falls vertically below the gall-bladder point.

The characteristics as to spread and limitation were similar to those noted in relation to the gall-bladder. Lateral spread was absent, but there was some vertical spread downwards towards, and sometimes overlapping, the tube point.

Out of 39 cases of tubal disease, 20 gave a positive response to pinch at the maximum point, with vertical spread as far as Poupart's ligament (never beyond), and in no case did spread exist laterally.

In 80 cases of gastric and duodenal ulcer, 50 gave a positive

response at the maximum point, which in all these cases was situated exactly in mid-line, midway between the ensiform process and the umbilicus. Spread occurred vertically in both directions, but never quite reached either umbilicus or ensiform process. Spread did not occur laterally in either direction.

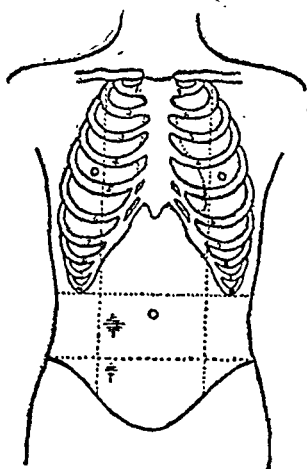
Speaking generally, the intensity of the hyperalgesia varies directly with the acuteness and the obvious inflammation of the organ as revealed at operation, although there are exceptions to this rule.

As illustrating this, I quote the following case:—

FIG. 2.—This diagram shows the areas of hyperalgesia to pinch found in Case 1. Note the appendix hyperalgesia is definitely more marked than that due to the right Fallopian tube. A much diseased appendix was found and removed. The right Fallopian tube, though somewhat swollen and inflamed, was not considered sufficiently damaged to require removal.

CASE 1.—Female, aged 34. Had been sent into hospital with diagnosis of right pyosalpinx. Patient had sharp, but not excessive, hyperalgesia over the appendix point, and definite, but not sharp, hyperalgesia over the right tube point. I did not think the hyperalgesia over the appendix point

sufficiently severe to explain the hyperalgesia at the tube point by spread, and I came to the conclusion that the right tube was pathological, although the condition of the appendix was the chief feature



of the case. At operation a much inflamed and adherent appendix was found and removed. The right tube was somewhat swollen and inflamed, but was not considered sufficiently damaged to require removal.

In this case the normal rule obtained; that is to say, the more obviously inflamed organ gave the sharper response to pinch. After a little experience, one can generally come to a correct reading of the significance of diffuse hyperalgesia, and determine whether it is due to spread from one set of spinal cells to another, or to two or more sets of cells receiving separate irritant stimuli from separate organs. For instance, if, in a case of acute cholecystitis, a sharp hyperalgesic response is obtained at the gall-bladder point, hyperalgesia may extend downwards for a considerable distance, and may overlap the appendix point. In such a case, the response to pinch becomes gradually less as one proceeds downwards, and is much less over the appendix point than at a point midway between the gall-bladder and appendix points. On the other hand, if one is dealing with a case in which an acute appendix is present as well as an inflamed gall-bladder, the hyperalgesia will show diminution from the gall-bladder point downwards, almost as far as the appendix point, but at appendix point will again be sharp, or perhaps sharper than over the gall-bladder point. This fact bears out the finding that hyperalgesia tends to spread much more in a downward than an upward direction.

When either of the three lateral organs is inflamed, that is, the gall-bladder, appendix, or Fallopian tube, the hyperalgesia produced by pinch, when present, nearly always shows the same characteristics. It looks as if certain twigs of the ninth, eleventh, and twelfth dorsal nerves were somatic representatives of the visceral supply of the gall-bladder, appendix, and right Fallopian tube respectively, and the question arises whether these somatic nerve endings arise from cells in dorsal spinal segments, which are themselves being directly irritated by impulses passing along the afferent visceral fibres from the organs mentioned.

It has been noted that intensity of hyperalgesia to pinch usually varies directly with the obvious inflammatory condition of the viscus at operation, but that exceptions occur

The following is a case which was an outstanding

exception, and one which convinced me that abdominal pain, tenderness, and muscular rigidity may be truly reflex in origin, and not necessarily due to local inflammatory condition, but that any factor which sufficiently stimulates the afferent nerve endings in the mucous or sub-mucous coats of the organ affected is sufficient to light up the whole train of symptoms.

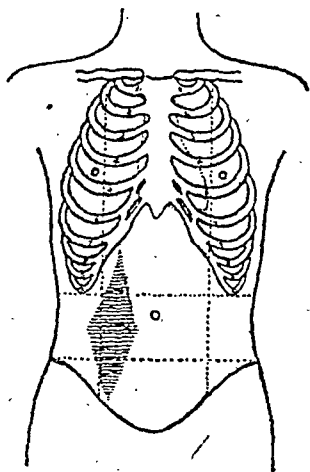


FIG. 3.—This diagram shows the very acute and widespread vertical hyperalgesia found in Case 2. Note that in either direction the hyperalgesia decreases as the distance from the maximum point increases. A thorn was found in this patient's appendix. There was no other abdominal lesion.

CASE 2.—The patient A. C., female, aged 44, schoolmistress. When I saw her she was lying in bed, with her knees drawn up, and looking extremely ill. She was complaining of great abdominal pain. She said the pain had come on suddenly, four hours previously, and that she had been well up to the moment of attack, but had had at once to leave school and go to bed. The whole right abdomen was motionless on respiration, her pulse was 100, temperature 99°. She was extremely tender to pressure from the right costal margin to Poupart's ligament, but was most tender over the appendix point. Her right abdominal muscles were quite board-like. When pinched at the appendix point, she screamed with pain, and the experiment was not

repeated. She had not suffered previously from indigestion or colic, and had not been of a constipated habit.

A confident diagnosis of a perforated viscus, with rapidly spreading peritonitis, was made, appendix or duodenum being the parts thought of. As the maximum hyperalgesic point had been the appendix point, I first opened the abdomen in the right iliac fossa; the parietal peritoneum was normal. There was no fluid of any kind seen, normal coils of small gut were found in contact with the parietal peritoneum, the appendix was found, and looked to all appearance normal, the serous coat was not injected, the cæcum and terminal loop of ileum were normal. I came to the conclusion the lesion must be above, and the stomach, duodenum and gall-bladder were explored and found normal. The tubes were then examined and found normal; the rest of the gut was then searched vainly for a perforation. Fortunately, I then removed the appendix, which, on being examined, was found to have a thorn sticking into its mucous membrane, the mucous membrane itself being normal in appearance.

I have seen many cases of general peritonitis, but I have

never seen a patient in greater agony than this woman, who had not a trace of peritoneal irritation. Peritoneum, viscera, and appendix looked at from the outside, appeared quite healthy. I can conceive of no explanation of this patient's board-like and tender right abdomen than that of spread of irritation along the spinal cord. There was no trace of peritonitis to account for the tenderness and rigidity, which were present far from the actual situation of the appendix. Next day, the patient expressed herself as feeling comfortable, and the right abdomen was relatively soft and pliable. The change was striking.

The other class of exceptions, the direct opposite to the above, is more common, and, if possible, more important. I refer to those cases in which pain and tenderness have been severe, but have passed off before one sees the patient, and one fails to elicit hyperalgesia to pinch. Sometimes one found a perforated appendix, and for a considerable time I thought that might be the explanation of the absence of hyperalgesia, for I was then inclined to think that tension of an organ was the commonest cause of hyperalgesia. Then cases turned up which were not actually perforated, and in which hyperalgesia had been negative. Then a striking case occurred, not in connection with the appendix but in connection with the small intestine, which turned my attention to the examination of the condition of the mesentery of the appendix as a possible guide to the explanation of the absence of hyperalgesia. The following was the case:—

CASE 3.—Male, aged 36, who, his doctor said, had had absolute obstruction for five days. The patient did not look ill, and had not been sick, nor had he up to this time felt sick; he was not distended, tender, or rigid, nor could I elicit a trace of hyperalgesia over any abdominal area. No tumour could be felt. Notwithstanding the fact that he had not been of a constipated habit, and had had aperients and enemata without result, I was disinclined to open his abdomen. Further aperients and enemata were given during the next twenty hours; the enemata returned practically unaltered, the aperients were vomited. Towards the end of this time he became definitely distended, and confessed to feeling not so well, his pulse was 70, his temperature normal, and there was no pain. I was still quite in the dark as to the cause of his obstruction, but was afraid to postpone operation any longer. An incision below the umbilicus was made in the middle line, and, on opening the peritoneum, a considerable quantity of blood-stained fluid escaped. A loop of distended small gut, about 2 ft. in length, which turned out to be ileum, then

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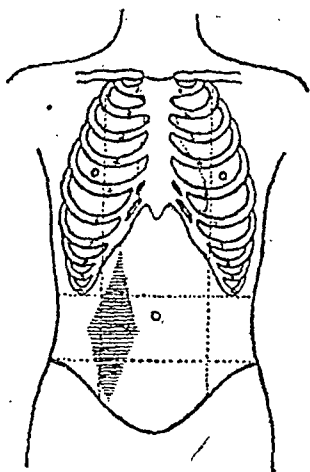


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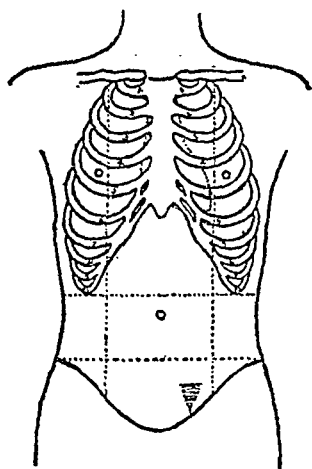
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presented itself. Its serous coat was plum-coloured, but had a definite sheen. When this loop was pulled clear of the wound, the mesentery corresponding to it was found to be a huge fan-shaped hæmatoma, about $\frac{1}{2}$ in. in thickness, the normal gut extended exactly up to the edge of the distended black gut at each end of the loop. The gut proximal to the affected segment was only slightly distended. This was evidently a case of thrombo-phlebitis of the mesentery—a condition now known to be insidious in onset as regards appearance of symptoms, although in two cases, published by Laplace,³ the patients seem to have suffered some pain. May not this symptomless onset in thrombo-phlebitis, so uncommon in small gut lesions, be due to blocking of the afferent impulses, which are carried from the gut to the spinal cord, by way of the sympathetic nerves in the mesentery?

This case led me to examine carefully all the mesenteries in cases of appendicitis on which I operated, and in which hyperalgesia had been absent. Some of these appendices



were perforated, some were gangrenous, but whether perforated or gangrenous, the mesentery of the appendix always showed signs of being infected, some being actually gangrenous, some thrombosed. It has occurred to me that in these cases the failure to find hyperalgesia may be due to block of the afferent impulses at the mesentery of the appendix on account of its gangrenous or thrombosed condition.

There can be little reasonable doubt that hyperalgesia to pinch is present in all acute cases of cholecystitis, appendicitis, and salpingitis at some stage of the case; that the maximum points are constant in position, whatever the causal position of the organ in the abdominal cavity; and that the

clinical facts as to its spread, its limitations, and direction are generally as given above.

CASE 4.—The first case in which I definitely found the precise position of the tube-point was a good illustration of these facts. The

FIG. 4.—This diagram shows the hyperalgesia which was present in Case 4. The position of the maximum point and the direction of the spread were typical. A left pyosalpinx was removed.

patient had been sent into hospital with the diagnosis of a mass in the pelvis. On pelvic examination, a tumour could be felt in the middle line, filling Douglas's pouch. The patient complained of pain when this was pressed with the finger, but could not define where the pain was felt. On examining the abdomen for hyperalgesia, a point was found on the left side exactly one quarter along a line drawn from the middle of Poupart's ligament to the umbilicus, pinching of which gave sharp hyperalgesic response. There was slight tenderness on pressure over this point also; there was little muscular rigidity. There was no extension of hyperalgesia in an upward direction; hyperalgesia of a moderate degree, but much less sharp than at the point, was present down as far as Poupart's ligament. There was no hyperalgesia near middle line, and there was no extension outwards.

At operation, two days later, the following conditions were found:—On opening the lower abdomen in middle line, neither tubes, ovaries nor uterus were exposed to view. Lying adjacent to the abdominal wall were coils of normal small intestine. On the right side, the coils were easily pulled up, and the right tube and ovary exposed to view; on the left side, a few superficial and normal coils were easily moved, but the deeper coils were firmly adherent to a large mass, which was deep in the pelvis. After separating many adhesions and adhesive coils of intestine, the mass proved to be the left Fallopian tube, completely filling Douglas's pouch. The tube was ruptured during removal, and pus, having the odour of *bacillus coli*, escaped. Since this I have seen several corroborative tubal cases.

Another point of importance is, that if hyperalgesia corresponding to a particular organ is demonstrated, one can conclude, in the majority of cases, that that organ has been the seat of the primary infection; organs adherent to it do not usually give any response to pinch over the diagnostic points. The following case was a good example of this fact:—

CASE 5.—A female, aged 32, was sent into hospital as a case of acute cholecystitis. The usual local signs were present, and a very sharp hyperalgesic response was elicited at the gall-bladder point. Hyperalgesic spread followed the usual rule: considerable downwards, less upwards, quite gone at middle line, slight spread in outward direction. At operation, the pyloric portion of the stomach was found to be wrapped round the fundus of the gall-bladder, and when separated, a much inflamed patch of the peritoneal coat of stomach, about the size of the palm of one's hand, was disclosed. The gall-bladder itself was distended, reddened, and full of pus, and there was ulceration of its mucous coat. Although such a comparatively large portion of the serous coat of the stomach wall had been inflamed, no hyperalgesia had been found at the gastric point. The explanation seems to be that as the afferent nerve endings lie in the mucous

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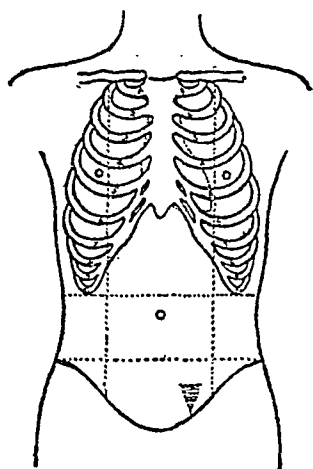


FIG. 4.—This diagram shows the hyperalgesia which was present in Case 4. The position of the maximum point and the direction of the spread were typical. A left pyosalpinx was removed.

aiding one to differentiate between organs, it may, in many chronic cases, be the deciding factor in diagnosis. In many so-called chronic cases, the response is sharp and unmistakable. These are usually cases which light up at intervals into definite attacks, and in which the patient is seldom really free from some pain and discomfort. There are other cases, many chronic tubal cases, or cases of gastric or duodenal ulcer, for instance, in which the response to pinch may be considered positive, although no actual pain is complained of when the skin and subcutaneous tissue are pinched, but a definite difference of quality of sensation is produced. The patient may call it more of a pinch, or uncomfortable, or different from the other place, and so on. As a good illustration of a chronic case, I quote the following:—

CASE 6.—Four years ago a patient had an appendix abscess drained; the patient was very ill, and no attempt was made to remove the appendix. Some months afterwards, the surgeon again operated, and the patient understood that, on this occasion, the appendix had been removed. The patient did not seem to improve, but complained, from time to time, of pain in the loin and right abdomen. The patient's medical man then sent patient to hospital, where a right pyelitis was diagnosed, and arrangements were made for admission. By the time a bed had been secured, the patient felt rather better, and refused to go in. So the case went on, sometimes rather better, sometimes worse. About five months ago, I saw the patient. There was an oblique scar over the appendix region,

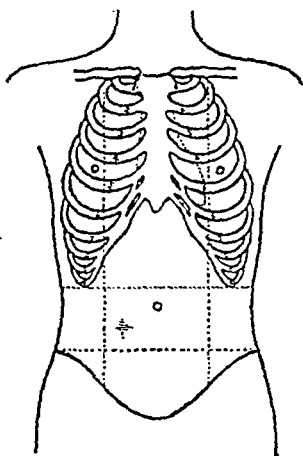


FIG. 6.—Illustrates the hyperalgesia found in Case 6. A much diseased appendix was removed from this patient. The case was a very chronic one, and pinch of the skin and subcutaneous tissue at the point indicated produced what the patient called "a very uncomfortable feeling."

there was no tenderness to pressure anywhere, but patient complained of vague abdominal pain, and had vague dyspeptic symptoms. Pinch at appendix-point produced what patient called a very uncomfortable feeling, the response elsewhere was normal. Cystoscopy showed normal ureteral orifices; there was no microscopic blood in urine or pyuria. Notwithstanding the history, I felt justified in searching for the appendix. It was found buried in adhesions, and was curled into a circle, the tip being firmly adherent to the

and sub-mucous coats, abnormal afferent impulses are much earlier created when an infection attacks a viscus from its mucous lining than when its peritoneal surface is attacked.

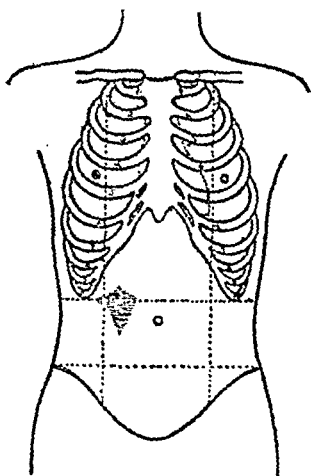


FIG. 5.—This figure shows the hyperalgesia present in Case 5. The patient had an empyema of the gall bladder. Note there is no gastric hyperalgesia present, although a considerable portion of the pyloric part of stomach was adherent to the gall bladder.

Wingate Todd,⁴ quoting Kelling, relates an interesting experiment which supports this view:—

“The fact that each nerve which distributes branches to the abdominal wall also supplies twigs to the alimentary canal, accounts for the hyperæsthesia and local contraction found in a part of the abdominal wall in diseases of the canal.

It accounts, too, for the alimentary reflex, the relaxation of the abdominal wall associated with distension of the alimentary canal. This is the reason for the tightness of one's clothes after a heavy meal. Owing to this reflex, a dog can, and often does, double its abdominal contents at a meal, without inconvenience.

That the arc is completed in the alimentary mucosa, and not in the peritoneum, is shown by the fact that the reflex is not called forth by the injection of air or saline solution into the peritoneal cavity.”

If, however, as the result of peritoneal implication, a kink is produced in an organ, such as appendix or gall-bladder, where efficient drainage is easily upset, and infection of the mucosa thereby set up, the viscerosensory reflex is disturbed, and hyperalgesia to pinch may be elicited. Most cases of tubal infection are good negative examples of this, for there are few cases of infected tubes which have not bound down to them inflamed serous surfaces of loops of gut, yet I have rarely been able to elicit hyperalgesia over the gut area in these cases. These observations relate to elicited hyperalgesia to pinch only; pain caused by irregular and violent peristalsis of the gut, resulting from the adhesions, is another matter altogether.

Although the exact localization of the maximum point of hyperalgesia to pinch is of great value in acute cases, in

response, showing clearly that two distinctly separate viscerosensory arcs were conducting abnormal stimuli to separate groups of spinal cells.

CROSSED IMPULSE.

Cases have been reported of left-side pain, when the organ on the right side has been at fault. I have never seen one, but the following notes are of a case in which hyperalgesia, due to sub-acute appendicitis, was present, not only at the appendix point, but at the corresponding point on the other side.

CASE 8.—Female, aged 25. Admitted to hospital as a sub-acute appendix. Very sharp hyperalgesia at the appendix point, shading off rapidly above and towards the middle line. No hyperalgesia at the middle line. Hyperalgesia spread towards and overlapped the right Fallopian tube point. On left side, sharp hyperalgesia at the point corresponding to the appendix point; here there was no spread. There was some tenderness on pressure over the appendix point and over corresponding point of left side. An incision in the middle line below umbilicus showed uterus, tubes, and ovaries normal; parietal peritoneum normal; many coils of normal small gut revealed; the left abdomen carefully examined for any abnormality, but none found. The appendix was found bound to the cæcum from its tip to its mesentery by a broad adhesion, tending to pull the appendix into the form of a semicircle; three very hard stercoliths were found in the appendix, the lumen of appendix was much contracted at the two points between the three stercoliths.

STOMACH, DUODENUM, SMALL
AND LARGE INTESTINE.

In grouping stomach, small and large intestine together and separating them as a group from gall-bladder, appendix, and Fallopian tube, I do not intend to indicate that there is any essential difference in the reflex phenomena elicited;

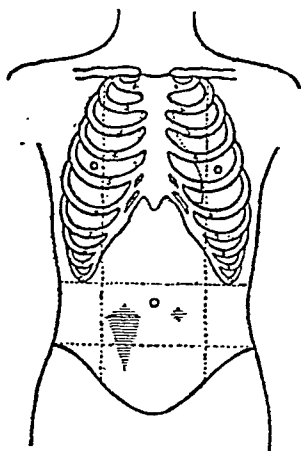


FIG. 8.—This diagram shows the crossed hyperalgesia formed in Case 8. Note the negative area between the two hyperalgesic areas. A diseased appendix was removed. The contents of the left abdomen were normal.

base. In the appendix was a small quantity of pus. The patient has been quite relieved of the symptoms formerly complained of.

CASE 7.—Perhaps I may quote another case, in which the symptoms were vague and mainly dyspeptic. The patient was a boy, aged 12, who, for some months, had been very costive, and complained of vague abdominal pain; his appetite was poor. When asked to put one finger on the spot where he felt the pain, he put his finger

on his umbilicus. He was neither rigid nor tender over any area, but gave a positive hyperalgesic response over the appendix point and at a point in the mid-line about an inch below his umbilicus; he did not mind pinching elsewhere. At operation, the appendix was found to have assumed the form of a "V," with the distal end pointing upwards and inwards. From the base down to the angle of the "V" the appendix was firmly adherent to the cæcum, the distal half was free; the ileum, about 4 ins. from the ileo-cæcal junction, was adherent to the cæcum at the angle of the appendix.

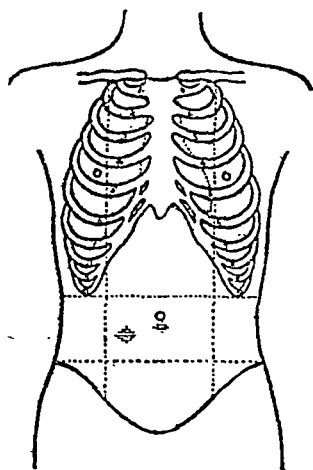


FIG. 7.—This figure shows the hyperalgesic areas found in Case 7. This boy had an adherent kinked appendix, and the ileum was adherent to the appendix about 4 ins. from the ileo-cæcal valve. Note the area negative to pinch between the appendix and small gut hyperalgesic points.

Sir James Mackenzie⁵ has stated that the probable explanation of the primary umbilical pain in acute appendicitis is irregular and excessive peristalsis of the lower coils of small gut. I do not know whether, in these early cases, hyperalgesia at the umbilicus exists, for I have had no opportunity of examining, but my usual experience

has been that irregular contraction of gut muscle, which has given rise to severe referred pain over a definite area, has not, at the same time, given rise to hyperalgesia to pinch in any part of this area. I am inclined to think, therefore, that the mere adhesion between the ileum and cæcum in this case did not explain the hyperalgesia, but that, had it been possible to do so, examination of the mucous membrane of the gut might have thrown light on the problem. It is interesting to note that, although there was definite response to pinch at the two points already mentioned, pinching of skin and subcutaneous tissue midway between these points gave a negative

Fallopian tube; whereas, in cases of peritonitis, due to perforation of gastric or duodenal ulcers, so far I have found it rather the exception to be able to elicit true hyperalgesia at the diagnostic point. The distinction becomes, therefore, a factor of diagnostic importance in attempting to determine the cause of the peritonitis under examination.

The distinction must have a physical basis and it will be found that the cases of gastric or duodenal ulcer, which have been negative to pinch, are those in which the tissue has become of an almost cartilaginous consistence, and in which the nerve endings have probably been destroyed. I do not mean that the disappearance of the hyperalgesia synchronizes with the perforation of the ulcer, but, that ulcers of this type may be quite negative to hyperalgesia, and that the fact of perforating (perhaps at this stage only the peritoneal coat), does not produce the reflex, as, indeed, one would not expect it to do. It is therefore, reasonable to argue that a patient who is known to have had a chronic ulcer, which gave a positive reflex, and who, otherwise, is manifestly not improving under treatment, and whose reflex becomes negative, is in greater danger of perforation than the patient who continues to give the reflex; for the disappearance of the hyperalgesia probably means progressive slow destruction of tissue, nerve endings included. It is obvious that this ulcer may well perforate without further warning.

Within the last month, I examined two cases of undoubted chronic gastric or duodenal ulcer, in the same ward, one was a man, aged 55, and he was quite negative to hyperalgesia. His general condition was such that I thought he might have a carcinoma of his stomach. The other man was 36 years of age, and gave a sharp response to pinch. Within 48 hours of the examination, the former patient had perforated, and a very chronic parapyloric ulcer was found, the tissue being described as almost cartilaginous to one's sense of touch. Under certain conditions, therefore, it would seem that the absence of hyperalgesia in a known case of chronic gastric or duodenal ulcer might well be an indication for operative interference without undue delay.

In a series of 80 consecutive cases of chronic gastric or duodenal ulcer between 50 and 60 per cent. have shown

the mechanism of the arc is similar, and the reflex is produced and obtained in exactly the same way. But in two details they do differ.

First.—The hyperalgesia produced is found in the middle line of the abdominal wall, somewhere between the ensiform cartilage and the symphysis pubis, the same rule as to vertical spread and its direction obtaining.

Second.—The hyperalgesia elicited is not usually so acute as that produced in ordinary cases of cholecystitis, appendicitis, or salpingitis, but it is definitely more persistent. For instance, it is quite common, in a case of catarrhal appendicitis, to find a very intense response to pinch one day, and 24 hours later, if the case has rapidly subsided, to be unable to obtain any response to pinch at all. As one would expect, hyperalgesia to pinch, when once obtained, persists in cases of gastric or duodenal ulcer, or in cases of a small-gut lesion, in which the cause is permanent.

One does find, in cases of undoubted gastric ulcer being treated by rest and dieting, that as the general symptoms become less urgent, so does the hyperalgesia to pinch gradually become less acute, and that it has usually become negative before the physician in charge of the case would consider the patient sufficiently improved to return to his or her ordinary avocation. As a matter of observation, I have noticed that the cases in which the hyperalgesia has disappeared under medical treatment are the cases which are usually discharged from hospital without having been transferred to the surgical side for operative interference, but that the cases in which the hyperalgesia to pinch persists, in spite of medical treatment, usually come under the care of the surgeon for operation.

Other rather curious differences exist between the phenomena produced respectively by the lateral and central organs. For instance, in cases of appendicitis, which have gone on to perforation and subsequent general peritonitis, although it may be difficult, yet by careful examination the organ primarily at fault can usually be diagnosed. That is to say, true hyperalgesia to pinch can usually be elicited at the appendix point, as well as in perforations of gall-bladder or

Fallopian tube; whereas, in cases of peritonitis, due to perforation of gastric or duodenal ulcers, so far I have found it rather the exception to be able to elicit true hyperalgesia at the diagnostic point. The distinction becomes, therefore, a factor of diagnostic importance in attempting to determine the cause of the peritonitis under examination.

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In a series of 80 consecutive cases of chronic gastric or duodenal ulcer between 50 and 60 per cent. have shown

distinct hyperalgesia to pinch at the gastric point. This point has, in my experience, been constant in position, and is situated in the middle line, exactly halfway between the tip of the ensiform cartilage and the umbilicus. Extension of hyperalgesia is nearly always vertical, downwards towards the umbilicus. A few cases have shown some extension upwards. I have been unable, so far, to distinguish between gastric or duodenal ulceration, or between an ulcer situated on the cardiac or pyloric portion of the stomach. In all these cases, wherever the lesion, the maximum

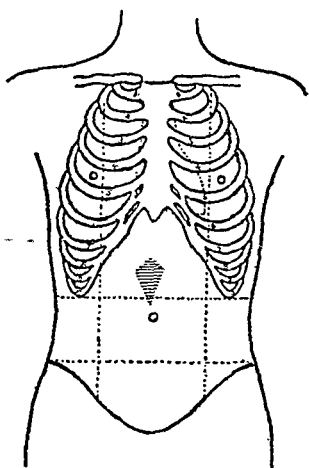


FIG. 9.—This figure shows the typical gastric hyperalgesic area found in Case 9. This patient had a large ulcer on the anterior wall of the stomach, near the lesser curvature, and the scar of an old ulcer near the pylorus. Note the close resemblance to the diagrams representing Cases 12 and 13.

point has been constant in position. Hyperalgesia sometimes exists higher than this point, but the response has always been sharpest at the situation above mentioned, and which I have come to regard as the diagnostic point. Spread has never occurred laterally. This point probably corresponds with the subcutaneous distribution of the anterior cutaneous branches of the ninth dorsal nerve. But Keith⁶ has pointed out that there may be a variation of nearly a whole segment in the abdominal wall. For instance, the umbilicus may be situated, either at the extreme lower limit of the ninth dorsal segment or the extreme upper limit of the eleventh dorsal segment. As an instance, I quote the following case:—

CASE 9.—Female aged 45, admitted to hospital, medical side. Definite hyperalgesia at gastric point, slight spread in downward direction, no hyperalgesia at higher level than mid-point between ensiform and umbilicus. No lateral spread to either side, but gradually diminishing hyperalgesia down nearly to the level of the umbilicus. Operation revealed a large ulcer on the anterior wall of the stomach, near the lesser curvature, the stomach wall at the site of the ulcer being adherent to the liver, and the scar of an old ulcer just on the gastric side of the pylorus.

As an instance of duodenal ulcer, I quote the following

case :—

CASE 10.—Male. Very definite hyperalgesia, at exact mid-point between ensiform and umbilicus; no hyperalgesia higher or lateral, either side, but diminishing hyperalgesia down nearly to the level of the umbilicus. Operation revealed an active, chronic, duodenal ulcer.

As an instance of multiple ulcers, I quote the following case :—

CASE 11.—Female, aged 45. Long been troubled with indigestion. Maximum point of hyperalgesia exactly midway between the umbilicus and ensiform cartilage. Slight extension vertically downwards, no extension in upward direction. At operation, three definite ulcers were found: two on the cardiac portion of the stomach, one near the pylorus.

Cholecystitis and a gastric or duodenal ulcer may co-exist, and the areas of hyperalgesia, when present in these cases, are very instructive and suggestive.

Unless the afferent visceral impulses are so urgent that accurate delimitation of hyperalgesia and spread is impossible, the following will be found to obtain—

(1) Hyperalgesia to pinch exactly at the gastric point, with or without vertical extension.

(2) Hyperalgesia to pinch at the gall-bladder point, with or without vertical extension.

(3) A definite area between the gall-bladder and gastric points on the same level, in the same segmental area, in the line of the

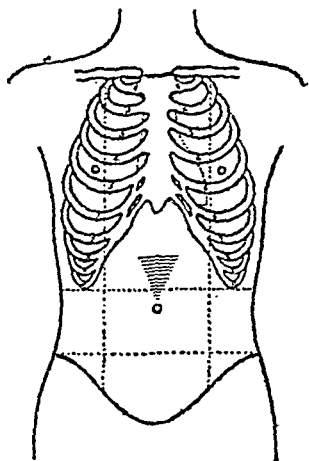


FIG. 10.—This figure shows the hyperalgesic area found in a male, who was proved, at operation, to have a duodenal ulcer (Case 10). Note how closely this figure resembles the preceding one.

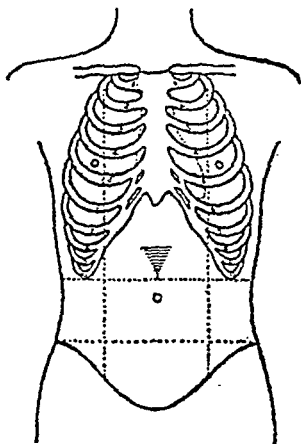


FIG. 11.—This figure illustrates Case 11. The patient was found to have three separate ulcers on the anterior wall of the stomach. Note how closely the hyperalgesic area resembles the areas found in the two preceding cases.

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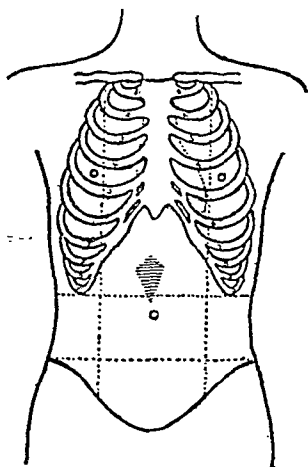


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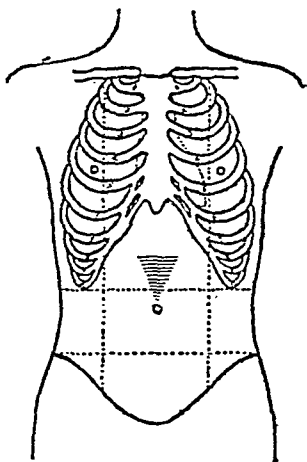


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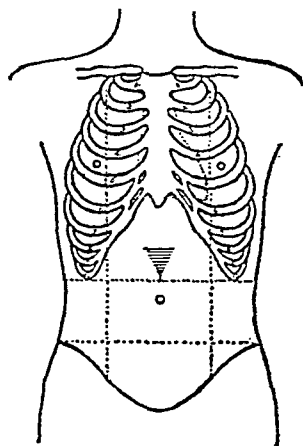


FIG. 11.—This figure illustrates Case 11. The patient was found to have three separate ulcers on the anterior wall of the stomach. Note how closely the hyperalgesic area resembles the areas found in the two preceding cases.

same dorsal nerve, and yet quite negative to hyperalgesia by pinch, showing conclusively that the hyperalgesia present at the respective maximum points is due to two separate stimuli, arising from two entirely different organs, each hyperalgesia, therefore, being the result of a true and distinctly separate viscerosensory reflex.

Notes of the following case illustrate this point:—

CASE 12.—Female, aged 55. Long history of pain and flatulence after food. Patient losing weight. No abdominal tumour felt, stomach dilated. Hyperalgesia at gastric point, definite but not sharp. Hyperalgesia at gall-bladder point present, but slight.

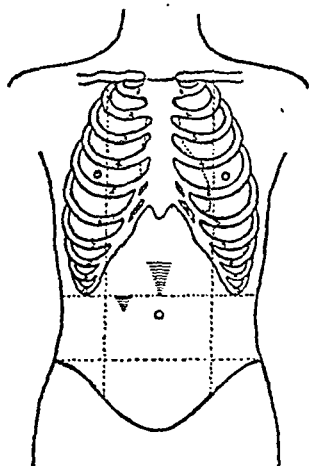


FIG. 12.—This diagram shows two hyperalgesic areas, the outer the gall bladder area, the inner the gastric area. This patient (Case 12) proved to have a chronic gastric ulcer and a cholecystitis. Note the negative area between the hyperalgesic areas.

There was no hyperalgesia present in the area between the gall-bladder and gastric points. The upper right rectus was somewhat rigid, and there was tenderness on pressure over it. Seven days later, patient re-examined and same reflexes elicited. At operation, a chronic ulcer, just on the gastric side of the pylorus, was found. From this, and first part of the duodenum, adhesions stretched to the fundus of the gall-bladder, which was pulled towards the middle line, producing a kink about midway between the fundus and neck. The gall-bladder showed undoubted signs of cholecystitis.

PERFORATED GASTRIC OR DUODENAL ULCERS.

In a series of eleven cases of perforated gastric or duodenal ulcer, carefully examined for hyperalgesia, four cases have given intense response. Seven cases were quite negative, although, in all cases, great muscular rigidity and tenderness on pressure obtained. In the cases which were positive, the maximum response was at the point already mentioned.

SMALL AND GREAT GUT PAIN AND HYPERALGESIA.

Small Gut.—I have had several cases in which hyperalgesia was clearly demonstrated in lesions of small gut, and of these cases, one has already been alluded to under chronic

appendicitis; another was a case of acute inflammation of Meckel's diverticulum, and is referred to below. The third was a case of obstruction of ileum by a band. The last I shall mention occurred recently. I watched it for some days, and carefully examined it twice, once on the day following admission to hospital, and again on the morning of the operation. Full notes are appended, for I consider it of great importance.

In cases of intestinal pain, unless patients are carefully questioned, their answers as to site and spread are apt to be very vague if the attack is over, and if they are asked to put one finger on the spot where the pain has been most severe, they may be unable to do so. Seen during an attack, a patient is usually able to put one finger on the spot where the maximum amount of pain is felt. The position of this spot is usually central, although the patient may say that the pain spreads round to each side of the abdomen in a horizontal line. I have never found pain, in a case which was demonstrated to be due to a small gut lesion, excluding first part of duodenum, to be higher than a point at the junction of the lower and middle thirds of a line drawn from ensiform to umbilicus, or lower than a point at the junction of the upper and middle thirds of a line drawn from the umbilicus to the symphysis pubis. The following are notes of five cases:—

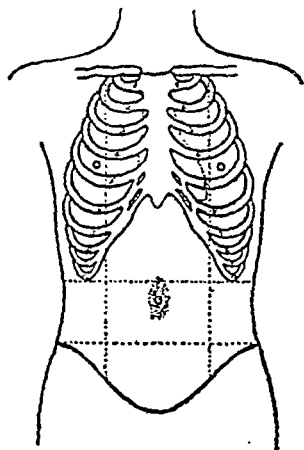


FIG. 13.—The stippled area shown in the figure shows the area to which this patient referred her pain (Case 13). At operation a carcinomatous stricture of the jejunum was found. Hyperalgesia was not found in this case.

CASE 13.—Female, aged 56. Had vomiting of pyloric obstruction, a much dilated stomach; had taken only fluid for some months. A tumour could be felt in pyloric region, hyperalgesia negative. At operation, what seemed to be a carcinoma of the pylorus was found. A posterior gastro-jejunostomy was done. Patient, who did well for twelve days, and had not been sick since operation, was now put on a more solid diet. On the thirteenth day the patient complained of sudden great pain, and was very sick. The vomited

same dorsal nerve, and yet quite negative to hyperalgesia by pinch, showing conclusively that the hyperalgesia present at the respective maximum points is due to two separate stimuli, arising from two entirely different organs, each hyperalgesia, therefore, being the result of a true and distinctly separate viscerosensory reflex.

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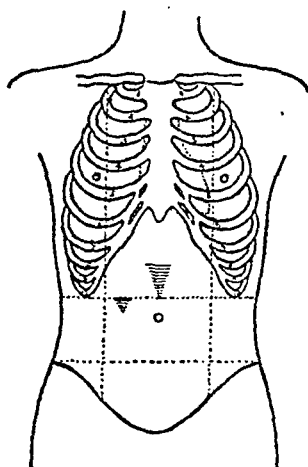


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PERFORATED GASTRIC OR DUODENAL ULCERS.

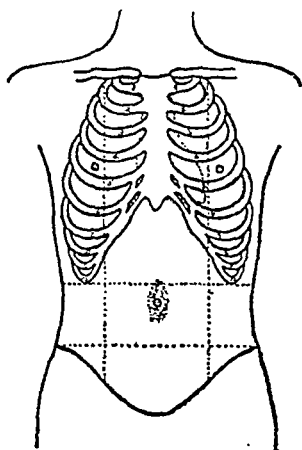
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appendicitis; another was a case of acute inflammation of Meckel's diverticulum, and is referred to below. The third was a case of obstruction of ileum by a band. The last I shall mention occurred recently. I watched it for some days, and carefully examined it twice, once on the day following admission to hospital, and again on the morning of the operation. Full notes are appended, for I consider it of great importance.

In cases of intestinal pain, unless patients are carefully questioned, their answers as to site and spread are apt to be very vague if the attack is over, and if they are asked to put one finger on the spot where the pain has been most severe, they may be unable to do so. Seen during an attack, a patient is usually able to put one finger on the spot where the maximum amount of pain is felt. The position of this spot is usually central, although the patient may say that the pain spreads round to each side of the abdomen in a horizontal line. I have never found pain, in a case which was demonstrated to be due to a small gut lesion, excluding first part of duodenum, to be higher than a point at the junction of the lower and middle thirds of a line drawn from ensiform to umbilicus, or lower than a point at the junction of the upper and middle thirds of a line drawn from the umbilicus to the symphysis pubis. The following are notes of five cases:—



CASE 13.—Female, aged 56. Had vomiting of pyloric obstruction, a much dilated stomach; had taken only fluid for some months. A tumour could be felt in pyloric region, hyperalgesia negative. At operation, what seemed to be a carcinoma of the pylorus was found. A posterior gastro-jejunostomy was done. Patient, who did well for twelve days, and had not been sick since operation, was now put on a more solid diet. On the thirteenth day the patient complained of sudden great pain, and was very sick. The vomited

FIG. 13.—The stippled area shown in the figure shows the area to which this patient referred her pain (Case 13). At operation a carcinomatous stricture of the jejunum was found. Hyperalgesia was not found in this case.

material was stomach contents, stained with bile, but not at all like the contents of biliary vomiting. She continued vomiting almost continuously, there was no hyperalgesia, but great pain was referred to the region already mentioned, and central in position. The abdomen was re-opened, and I found all well with the junction, but considerably distended small gut below, extending from the junction, about 3 feet down the jejunum. At this point a stricture was found and excised. It had all the appearance of a malignant stricture, and has since been proved to be a carcinoma. Obstruction had evidently been set up at this stricture when the patient attempted to take solid food. It is interesting to note that she had been on fluid diet for some months before operation.

CASE 14.—Female, aged 61. Patient complained of occasional sickness, was very thin, looked ill, and was constipated. Tumour

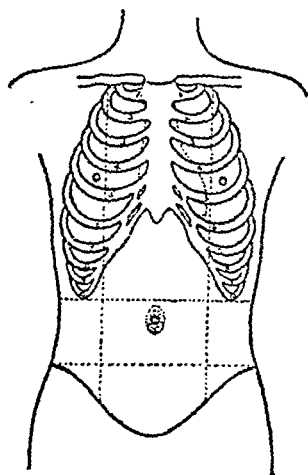


FIG. 14.—The stippled area represents the position to which the patient referred her pain. There was no hyperalgesia. The patient had a carcinoma of the transverse colon, but no evident abnormality of the great gut proximal to the growth, whereas the last few coils of ileum were much distended and injected (Case 14).

was felt in upper abdomen, just to the right of the middle line. There was no hyperalgesia or tenderness over any part of the abdominal wall, but patient complained of pain of a colicky type, although not severe in character, quite central in position, and having definite small gut limits. This position of pain puzzled me, for I thought the patient had, probably, a malignant growth of the transverse colon. All the previous evidence at my disposal showed, that pain due to irregular and violent peristalsis of the great gut was referred to a point or area in the lower two-thirds of a line drawn from the umbilicus to the symphysis pubis. This patient's pain definitely did not extend more than 2 inches below the umbilicus; I, therefore, thought I had come across a case which was going to prove exceptional. At operation, an incision was made over the tumour, and the tumour was found to be a carcinoma of transverse colon, situated about its middle. No free fluid was seen in the upper abdomen. The growth was operable, but was not resected at this time. I closed the wound, and made another incision through the lower left rectus

with the intention of short-circuiting the growth. When the abdomen was opened here, free fluid was found to be present in the pelvis, and moderately distended and reddened coils of lower ileum appeared. There was no abnormality at the ileo-cæcal valve, nor were

cæcum nor ascending colon distended. I can offer no explanation of the condition of the lower ileum, but it was such that I had to take a piece of small gut for the junction much higher than I otherwise should have done.

This was a case in which I expected the position of the lesion to be anything but a confirmation of the theory of referred pain, due to small gut being always present within the limits mentioned above. One would, naturally, have expected that, with a growth nearly in the middle of the transverse colon, the patient would have suffered from great gut colic. When the parts were exposed, no abnormality of great gut proximal to growth was found, but the condition discovered showed the clinical symptoms unexpectedly confirmed by the condition of the lower ileum.

CASE 15.—Female, aged 47; November 28, 1914. Date mentioned because, on October 4 of the same year, I had removed a twisted right ovarian cyst from the patient and at the same time removed her appendix. This was before I had definitely come to a conclusion regarding maximum points as being diagnostic in character. My note *re* hyperalgesia on October 4 says: "Hyperalgesia marked over cæcal region and right down to Poupart's ligament." I have now no doubt that the maximum point in this case was really the tube point, and that the hyperalgesia over appendix area was due to spread. This patient was again taken suddenly ill on November 28, and the following are the notes on the case:—

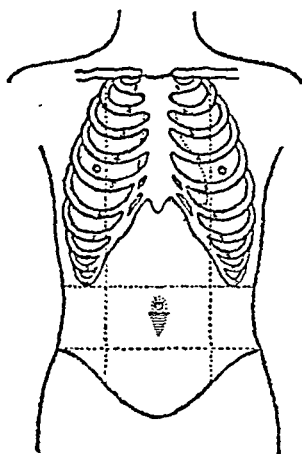


FIG. 15.—This figure shows the areas of pain and hyperalgesia present in Case 15. This shows a typical small gut area, and the patient was found to have a Meckel's diverticulum, which was much inflamed, and a loop of obstructed small gut. The stippled area represents the spot to which the patient referred her pain, and the area dashed by lines is where very acute hyperalgesia to pinch was found.

"Has been vomiting all night, abdomen not distended, skin and subcutaneous tissue of abdominal wall exquisitely tender to pinch just below umbilicus in mid-line, the patient having frequent attacks of agonizing colic, this colicky pain being exactly localized to the umbilical region." At operation an incision in mid-line below the umbilicus was made. On opening the abdomen, coils of dilated and reddened small gut presented themselves; these coils, traced down into the pelvis, led to the discovery of the true cause of obstruction—a Meckel's diverticulum adherent to a neighbouring coil of intestine by its tip and twisted on its long axis, distal third of diverticulum gangrenous. Under the band thus formed were two coils of

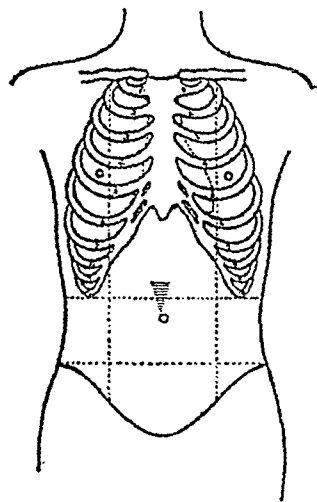


FIG. 16.—This diagram shows the area of hyperalgesia found in Case 16. Obstruction by band of a loop of small gut was found. The area is higher than usual, and in this case there was no hyperalgesia found below the level of the umbilicus.

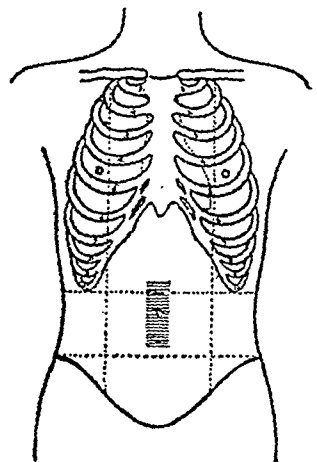


FIG. 17A.—This diagram shows the uniform distribution of the hyperalgesia as found in Case 17 when first examined. It illustrates well the whole small gut area.

small gut, with somewhat constricted lumen; the diverticulum was about 3 inches long, and would just have admitted one's forefinger; I had not noticed this diverticulum at the previous operation.

CASE 16.—Female, aged 68. Obstruction for three days, abdomen distended, constant griping pain just above umbilicus, no pain below, patient been sick twice, definite hyperalgesia to pinch at junction of lower and middle thirds of line from ensiform to umbilicus. At operation great distension of small gut was found, a band of omentum, stretching from the gall bladder to the mesentery of loop of ileum, and another loop of ileum, absolutely obstructed by having slipped underneath band. Much blood-stained fluid in the peritoneal cavity.

CASE 17.—J. F., male, aged 64. Admitted to hospital March 20, 1916, with an indefinite diagnosis. He had been sick once, and his temperature and pulse were slightly raised; he complained of considerable abdominal discomfort. I first saw him on March 21, and elicited the following signs:—Sharp hyperalgesia to pinch exactly in mid-line, extending the whole length of the small gut area. It was impossible, in the small gut limits, to distinguish a maximum point, the entire length being uniformly hyperalgesic. There was some spread as far as the gastric point, and also some spread into great gut area. A tumour, about the size of a tangerine orange, could be felt in the right iliac fossa, and the patient winced and complained of pain when pressure was made on the tumour through the abdominal wall. There was no distension of the abdomen, and patient's bowels had acted. I decided to watch him and re-examine him. On March 25, I re-examined him. The patient's general condition had been

improved by the few days' rest in bed, aperients had acted, and he had less abdominal discomfort.

He responded to pinch as follows:—

One maximum point, situated 1 in. below the umbilicus. From this, hyperalgesia spread, steadily diminishing in intensity upwards and downwards, the spread downwards fading off at the junction of the small and great gut areas. The upward spread faded out before one had reached the gastric point. Here, again, the normal rule as regards spread was well illustrated. No lateral spread, and downward vertical spread more pronounced than upward vertical spread.

Operation on March 25.

Incision below umbilicus in mid-line. No free fluid in abdominal cavity. Last 2 ft. of ileum moderately distended and reddened. The distended loop traced to cæcum, ended in the tumour, which had been felt through the abdominal wall, and which proved to be a carcinoma situated at the ileo-cæcal junction. The tumour was fixed to the posterior abdominal wall, and I did an ileo-sigmoidostomy. I went some distance up the ileum to choose a piece for the anastomosis, but even here the mucosa was much swollen and red. It is very probable that actual ulceration of the mucous membrane of the terminal loop of ileum was present.

Great Gut.—With one exception, all my experience of pain due to a great gut lesion, has been in cases in which a definite obstruction of the great gut has been present, somewhere from the hepatic flexure onwards.

The obstruction has usually been mechanical, but in one case, was due to an idiopathic dilatation of the transverse colon. The exception noted above proved to be a perforation of the first part of the ascending colon, and presented features quite unlike any of the other cases, both as regards the situation of maximum pain felt by the patient, and the situation of the elicited hyperalgesia. The maximum pain, with this one exception, has always been central in position, and situated in the lower half of a line drawn from the umbilicus to the

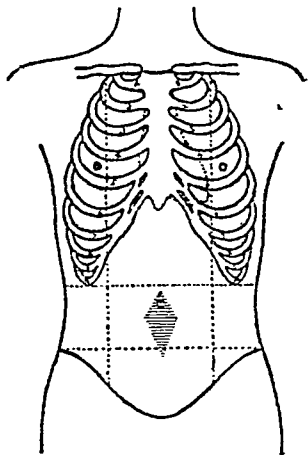


FIG. 17B.—This figure shows the area of hyperalgesia as found in Case 17 on second examination. Note a maximum point with typical spread is now shown. The patient was found, at operation, to have a carcinoma of the ileo-cæcal valve which was causing considerable small gut obstruction, the lower few feet of ileum being specially affected.

symphysis pubis. Hyperalgesia, when obtained, has definitely been situated in the lower third of the line mentioned, except in the case of perforation of the ascending colon, in which the hyperalgesia and pain were both definitely situated to the right of the middle line, and practically occupied the usual right tube area.

The case next quoted is interesting, as showing that crushing and cutting of gut can produce pain, although the pain is not localized to the gut injured, or even to the abdominal wall in proximity to the loop of the injured gut.

CASE 18.—The case of the patient already mentioned in connection with the carcinoma of the transverse colon. Three weeks after the short-circuiting operation the growth was excised, the original upper abdominal scar being cut out. Crile's method of local anæsthesia

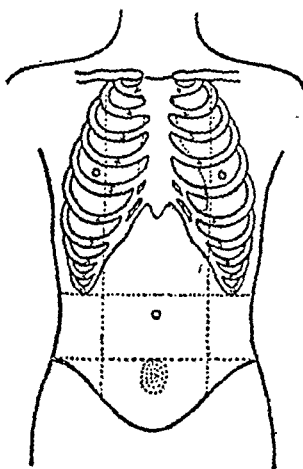


FIG. 18.—The stippled area in the figure shows the area to which this patient referred her pain after excision of the carcinoma of the transverse colon (Case 18). There was no hyperalgesia found. The incision was made just to the right of the middle line above the umbilicus.

was used for the abdominal wall, in conjunction with a general anæsthetic. This patient suffered more than usual post-operative pain, and she had to have rather frequent doses of morphia to render it bearable. The pain was entirely referred to the lower abdomen, in the mid-line, far from the area tampered with during the operation. Its maximum point was rather lower than midway between the umbilicus and the pubis. There was no hyperalgesia.

The next two cases illustrate the fact that, although the history of a case might lead one to expect a certain abdominal lesion, yet, if by careful examination the area of referred pain and hyperalgesia are found to point to a lesion of another part of the gut, it will be found that the situation of the pain and hyperalgesia is the more reliable guide.

CASE 19.—Patient, male. Admitted to Middlesex Hospital evening of December 31, 1915. This patient had had two previous abdominal operations; the first an ileo-sigmoidostomy, and the other a short-circuiting of two loops of small gut. He was sent in as a case of acute obstruction of the small intestine. On being asked

where his pain was, he put his hand on a spot which corresponded to the junction of the lower and middle thirds of the mid-line from umbilicus to pubis. There was no hyperalgesia. Notwithstanding his history, I felt confident, from the position of his pain, that we had a great gut obstruction to deal with. So it proved to be.

CASE 20.—The patient, a female, aged 57, was admitted to Middlesex Hospital in June of 1915, suffering from a strangulated right femoral hernia. Sir John Bland-Sutton operated, and resected about 6 ins. of ileum. The patient made an uninterrupted and perfect recovery.

She was re-admitted at the end of March, 1916, suffering from pain and partial obstruction. Before examining this patient, I had looked up the old notes relating to her case, and formed the impression that, in all probability, she was again suffering from a small gut obstruction. When the abdomen was uncovered, I asked her to show me, with one finger, the exact spot where she felt the greatest pain. Without any hesitation, she placed the point of her finger exactly in the middle line of her abdomen, and at the junction of the lowest and adjacent fourths of a line drawn from the umbilicus to the symphysis pubis. Sharp hyperalgesia to pinch was also elicited at the same point, with slight vertical spread in either direction. There was no lateral spread. There was no other hyperalgesic point.

Sir John Bland-Sutton operated on April 3, and found a carcinoma of the pelvic colon. The small gut anastomosis, previously made, was found to be functioning perfectly, and of the same lumen as the loop of small intestine immediately proximal to it.

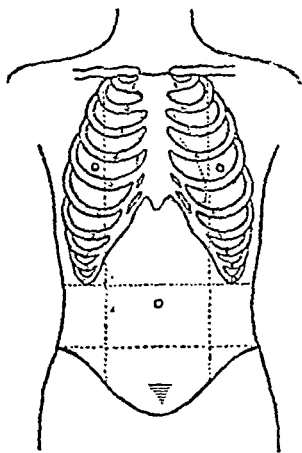


FIG. 19.—The diagram shows the position of the pain felt by the patient and the hyperalgesia elicited (Case 20). At operation a carcinoma of the pelvic colon was found.

The next case was one of purely paralytic obstruction, the most careful search distal to the dilatation failing to find any mechanical obstruction due to growth or other cause.

CASE 21.—Male, aged 58. Has had occasions during the past year in which the gut only acted with difficulty. Up to present attack, aperients have been successful. Has had obstruction for 24 hours, has had severe cramping pain in lower third of abdomen. Abdomen greatly distended, no hyperalgesia elicited at any point. Under chloroform, a large resonant tumour could be moved about from side to side, the tumour extending down into the pelvis. At operation an incision in mid-line was made. An enormously distended

transverse colon presented; no free fluid in the peritoneal cavity. The transverse colon was hanging down in the abdominal cavity like a hugely dilated sausage, and practically filled the abdominal cavity. The limbs were traced up to the splenic and hepatic flexures respectively; at flexures they suddenly became normal. No growth or other abnormality was found to explain the distension, which seems to have been a genuine idiopathic dilatation of the transverse colon. Although this enormously dilated transverse colon practically filled the whole abdominal cavity, no tenderness, even to deep pressure, was found over any part of the abdominal wall, but all the pain the patient suffered was referred to an area of almost central position in the lower third of the abdomen.

The last case relating to great gut, which I shall quote, was one of extreme interest.

CASE 22.—The patient, a female, had felt ill for some days before admission to hospital, but had suddenly become worse. In hospital, she complained of a considerable amount of abdominal pain, and a tumour could be felt, occupying the cæcal region. She was rigid and tender all over the right iliac fossa, but the spot of greatest tenderness practically corresponded with the right tubal point, and there was definite hyperalgesia to pinch there as well.

Sir John Bland-Sutton operated. A considerable amount of local peritonitis was found around the region of the tumour, which proved to be a much thickened cæcum and first part of ascending colon, the first part of the ascending colon having perforated.

This is the only case of a perforation of ascending colon. I have had the opportunity of examining, and it undoubtedly raises a question as to the site of the referred pain and hyperalgesia in these cases; but further investigation of lesions of this part of the great gut is necessary before any definite statement can be made.

The following cases have proved negative to hyperalgesia :—

Lead colic—two cases. Carcinoma of pancreas—six cases, three of which had given rise to great pain. Conditions implicating the peritoneal coat alone such as abscesses in peritoneal cavity, pneumococcal peritonitis—seven cases, tubercular peritonitis—eight cases. Slow distension of a viscus—common bile duct.

CASE 23.—Male, aged 69. Absolute obstruction of common duct for eighteen months, extreme jaundice. No pain of any kind. No hyperalgesia. At operation, the common bile duct was found to be enormously distended, gall-bladder also distended. The obstruction was found to be due to a malignant growth of papilla of Vater, which I excised by the trans-duodenal route.

Rapid distension of viscus probably without lesion or

mucosa :—

- (a) Case of idiopathic dilatation of transverse colon.
- (b) Female, aged 31.

CASE 26.—Sudden acute but ill-defined abdominal pain; localization of pain by patient impossible. No hyperalgesia present. Found, on operation, to be caused by bleeding into a left ovarian cyst.

CONDITIONS IN WHICH DIFFICULTY MAY BE FOUND IN TESTING THE REFLEX.

(1) In cases in which general peritonitis has supervened, especially if the abdomen is considerably distended. Here the greatest care must be taken to avoid pressure on the abdominal wall, for direct pain will be immediately produced by excitation of the much irritated plexus of nerve endings present in the subperitoneal tissue. Nevertheless, by careful application of the method, strong evidence may be obtained, which, when taken into account with all the other available facts, may enable an accurate diagnosis to be made of the organ originally at fault.

(2) In neurotic patients who may, or may not, be suffering from an intra-abdominal lesion. These cases may be very troublesome, but where a suspicion of neurosis is aroused, careful examination will usually enable one to discriminate, and more often than not a quite atypical spread will be found.

In this connection, one must always bear in mind that a patient may be markedly hysterical, and yet be suffering from a genuine intra-abdominal lesion.

(3) In cases in which, although there is no general peritonitis, a severe local peritonitis is present with co-existing local inflammatory oedema of the abdominal wall. This is especially liable to occur in cases of appendicitis, when one may have a typical response at the appendix point, and at the same time an apparent hyperalgesia at another point, perhaps further out or lower down. Careful examination, however, will show that the apparent second hyperalgesia is, in truth, due to a local inflammatory condition of the body wall, and not to a true reflex.

CONCLUSIONS.

(1) That for diagnostic purposes all visceral pain may be regarded as due to a true viscerosensory reflex.

(2) That spread does not take place uniformly from

transverse colon presented; no free fluid in the peritoneal cavity. The transverse colon was hanging down in the abdominal cavity like a hugely dilated sausage, and practically filled the abdominal cavity. The limbs were traced up to the splenic and hepatic flexures respectively; at flexures they suddenly became normal. No growth or other abnormality was found to explain the distension, which seems to have been a genuine idiopathic dilatation of the transverse colon. Although this enormously dilated transverse colon practically filled the whole abdominal cavity, no tenderness, even to deep pressure, was found over any part of the abdominal wall, but all the pain the patient suffered was referred to an area of almost central position in the lower third of the abdomen.

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Rapid distension of viscus probably without lesion or

THE REACTION OF THE CHILD TO A FAULTY ENVIRONMENT.

By HECTOR CHARLES CAMERON, M.D., F.R.C.P.

*Physician in charge of the Department for Diseases of Children,
Guy's Hospital, etc.*

IN my last lecture* I sketched, shortly, the clinical symptoms of children suffering from persistent and multiple catarrhs of the skin and mucous membranes, a condition which I called the catarrhal state, and which, I suggested, was identical with the so-called status lymphaticus. Further, the various factors which combined in its causation, heredity, faults of hygiene, faults of diet, were discussed in turn.

I come, now, to consider how the condition may be controlled, both in the community and in the individual. I will, therefore, deal shortly with the chief ways in which the State and the Municipalities have endeavoured to meet the problem. These are: firstly, by housing reform and by the provision of open-air schools and parks; secondly, by the provision of free meals for school children; thirdly, by efforts to secure clean milk for the people; fourthly, by school inspection and the establishment of school clinics; and, fifthly, by the establishment of infant centres and mothercraft schools.

(1) HOUSING REFORM.

It may be asked what the requirements of a suitable house for children are; a question which will be found of importance in practice. Good ventilation is the first essential. Contact-infections do not take place so readily in a room in which the air is in constant motion; consequently, no young child should ever be confined in a space in which the air is stagnant. Now, good ventilation is difficult to obtain, unless the house is sufficiently narrow, from before backwards, to permit of a constant stream of air passing

* THE PRACTITIONER, July, 1916.

segment to segment, but that hypertonicity, which has been set up in a certain group of spinal cells, is communicated to an adjacent group of cells which subserve the same physiological function in the spinal cord, and that the lower group of cells is the more strongly stimulated. That impulses do not pass easily from the cell groups in the spinal cord, which correspond to the lateral organs (gall-bladder, appendix, and tube), to the spinal cells, which correspond with the central organs (stomach, duodenum, and gut).

(3) That hyperalgesia elicited by pinch is of definite value for diagnostic purposes, and, under certain circumstances, for prognosis also, but that a certain percentage of negative cases exist, and that the method should be used only as a part of, and as an addition to, general clinical examination.

(4) That positive response indicates, in the majority of cases, the organ primarily diseased.

(5) That the explanation of a percentage of negative cases, and very serious cases, is block of afferent impulse.

(6) That slow distension of a viscus does not give rise to either pain or hyperalgesia.

(7) That rapid distension may give rise to pain, but that the pain cannot be localized by the patient to the offending organ—that response to hyperalgesia is negative.

(8) Probable factors giving rise to hyperalgesia:—

- a. Mechanical irritation of nerve endings in mucous and submucous coats, as in Case 2.
- b. Diapedes is causing mechanical pressure on nerve endings.
- c. Chemical toxins produced by organisms.
- d. (*doubtful*) Irregular and excessive contraction of gut muscle *per se*.

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- ² Goulstonian Lectures, *Lancet*, 1911.
- ³ Surgical Congress, 1914.
- ⁴ *The Clinical Anatomy of the Gastro-Intestinal Tract*.
- ⁵ *Symptoms and their Interpretation*.
- ⁶ Treve's *Applied Anatomy*.

the poorest class. The slum child is eating nearly all the time; whenever he clamours, his mother cuts him a generous slice of bread. Bread, biscuits, cake, and sugar compose his diet. It is natural to suppose that when school hours enforce longer intervals between meals, the children should benefit greatly by the provision of a nutritious mid-day meal, in which the proportion of fat and protein is relatively high.

(3) MILK LEGISLATION.

We know how impure the milk supply of our cities is, and how frequently it contains tubercle bacilli. In the United States of America, a great deal of attention has been paid to this matter, and legislation has been enacted, which makes it illegal to sell milk for consumption by children if it has a bacterial content above a certain figure, and recognizes as "certified" milk only milk which conforms to certain very stringent regulations. In this country, we sometimes see "certified" milk sold, but the certificate is supplied by the vendor himself. In the United States, certified milk must be obtained from tubercle-free cows on inspected farms, and must contain less than 10,000 bacteria per c.c. To obtain milk with so low a bacterial content is not difficult, but the care necessary to produce it raises the price very considerably.

There is, at the present time, a strong body of opinion which desires to induce our Government to enact legislation which will establish the State certification of milk. It is recognized that to provide certified milk for the poor is impossible on the score of expense alone, but it is argued that the best way to improve the ordinary milk supply is to allow State certification of any milk which achieves the necessary standard, and trust to the force of example to raise the quality of the rest. No doubt State certification of milk would be desirable from many points of view. At present, ordinary market milk is often put into bottles and sold under the name "Nursery milk," or "Sterilized milk" by dishonest tradesmen, and neither the customers nor the dairies of high standard, whose milk would conform to the necessary standard for certification, have any redress. State certification would doubtless prevent such frauds, but

between the windows at the back and the windows at the front. The ideal nursery for children has windows on opposite walls. In times of great heat, when efficient ventilation is most necessary, such a room is cooled by the strong current of air which passes through it from the window in the wall which is heated by the sun to the window in the wall which is in the shade, and the hotter the day, the stronger the current of air. If this is impossible, the door at least should be opposite the window, and should open into a space, ventilated in turn, from the opposite wall of the house.

Even among the well-to-do, one has ample opportunity of noticing how pernicious may be the effect of faulty ventilation upon children. Many flats—that is to say, houses which are composed of a collection of rooms opening on to a common stair, the rooms themselves forming part of a huge building, often with windows opening in one direction only—constitute a bad environment for a young child. Similarly, among the poor, the mortality among children in so-called back-to-back houses is believed to be always higher than elsewhere. Underground rooms, rooms lit by skylight, rooms whose windows open into some airless court or alley, or do not open at all, have much to answer for. Want of sanitary accommodation, want of water, want of cooking and of cooking apparatus are common evils; but want of sun and air is worst of all. The provision of homes with proper ventilation is the only way to prevent infection of the children; all the other means are subsidiary to this. Open-air schools, parks, open-air playgrounds cannot overcome the mischief wrought by the dark, stuffy, and crowded homes.

(2) FREE MEALS FOR SCHOOL CHILDREN.

Those who are qualified to observe are strongly of opinion that by the provision of mid-day dinners for school children in London much good has been accomplished. The system was introduced about three years ago, at considerable expense.

I think it would be an interesting thesis for someone to take for his degree, to determine accurately the caloric value of the food consumed daily by a series of children of

with conjunctivitis, bronchitis, otitis media, and dermatitis as well. The frequency with which these different catarrhs occur simultaneously is, it seems to me, evidence against the view that the catarrh of the bowel is due to a specific infection conveyed by milk. Nor does it appear that boiling, or Pasteurizing the milk is effective in preventing diarrhoea, although it is a wise precaution. When Pasteur first discovered the extent to which our ordinary market milk was contaminated with bacteria, and when, a little later, Soxhlet devised his simple apparatus for Pasteurizing milk in the home, no one doubted but that the cause of all this infantile sickness had been laid bare, and the highest hopes and expectations were aroused. As we know, these hopes have been largely disappointed, and the reason is that the catarrh of the intestine is not commonly due to specific infection. That outbursts of acute enteritis, due to infection of the bowel wall by bacteria conveyed in milk, occur, and even with some frequency, I do not deny, but they are not the cause of the high rate of sickness among children.

Great and sustained heat is prejudicial to infants and young children, not because every year without fail sees an epidemic of infective enteritis due to the accidental contamination of milk with an unknown organism, but because the infant's power of regulating its heat-loss and heat-formation is not yet well established. If the young child, and especially the feeble child suffering from chronic catarrhal infections, is exposed to great cold, it cannot produce sufficient heat. Similarly, it is unable to ward off the ill-effects of great heat as does the adult. In hot weather the tolerance for food rapidly falls, whilst the intake of food is greater than ever, because of the increased thirst,—a thirst which is still further increased when diarrhoea and vomiting become established. With a fall in tolerance and a rise in the intake of food, fermentative dyspepsia is rapidly produced, with the well known green, acid, watery stools.

To sum up, whilst acknowledging that clean milk would be a great boon, let us recognize too that the contamination of milk does not lie at the heart of the whole question of infant mortality, but that the housing conditions and contact-infections remain the chief causes of infantile

we are dealing here with the means by which the general ill-health of the children of our towns can be prevented, and in this we can look for but little help from State certification.

Fortunately, bacterial contamination of milk is a relatively unimportant source of infection for the child, whether we are considering the question of tuberculosis, or the question of infantile diarrhoea and enteritis. In the past, by paying too great attention to this factor, we have neglected what is clearly the great danger to child-life, namely, contact-infection. Of what use to scrub the udder of the cow, and sterilize the milkman's overall, if the child's home is dark and comparatively airless, if the mother's breath is foul from pyorrhoea alveolaris, and the lodger expectorates tubercle bacilli unchecked? Too much attention is being devoted to-day to attempts, foredoomed to failure, to destroy infectious material, and too little is done to build up the individual child's resistance by proper hygiene. If clean milk could be provided, the results would fall far short of the hopes of the ardent advocates of milk legislation; whilst the large sums of money, which would need to be spent upon the inspection, isolation, and destruction of cattle, would be better expended in providing suitable homes for thousands of children, now being reared in an environment in which health is impossible.

When I see these unhealthy children of the poor breaking out simultaneously into catarrhs in almost every situation where examination is possible, I cannot believe that specific infection of the milk supply is the common cause of enteritis. It is true that dirty milk is more apt than clean milk occasionally to be contaminated with organisms which are capable of producing specific infections, such as diphtheria, enteric fever, or tuberculosis. But the children of our poor are not dying in thousands from diphtheria, enteric fever, or even from tuberculosis; they are dying of infections which, in other branches of medicine, we call "terminal infections," because the lowered resistance of the patient has given increased powers for evil to bacteria which are universally present.

No doubt it is conceivable that infected milk may produce enteritis, but it clearly cannot infect the child at the same time

which especially school inspection deals, permanent alterations in the shape of nose, palate, jaws, and chest, with deafness, dental caries, and spinal curvature.

(5) INFANT CENTRES.

It is the great merit of Infant Centres that they deal with departures from the normal in their earliest stages, and therefore in their most easily controllable form.

It may be asked: What is done in the Infant Centre? London is covered with filthy houses, full of children, yet absolutely unsuitable for children. What good can we do by inspecting children away from the house in an Infant Centre? I have not time to detail all the activities of the Infant Centre. Mothers are visited, homes are inspected, cleanliness is insisted on, clothing is supervised, and diet controlled. But take the single point that in an Infant Centre the baby is weighed every week. What is the significance of a steadily-gaining weight? If we can point to a satisfactory gain week after week, we have provided the child with a certificate of high resistance against contact-infection, and of immunity against those acute infections which are termed "terminal infections."

We should do all we can to keep the surroundings of the child clean, but some dirt there must be, and the child whose weight is gaining steadily has an armour of living, healthy resistant cells in skin and mucous membrane to oppose to all invasion by bacteria. Remember that for a child's weight to remain stationary for several weeks or months is as serious as for an adult's weight to show a steady fall, and in both when a certain percentage of the body weight has been lost we must expect terminal infections. To the mother the onset of the child's illness often seems sudden enough. The stage merely of disturbed weight is not noticed by the mothers, and for months the weight may be stationary while the catarrhal infections remain comparatively quiescent, although obvious enough to the trained eye. Let the mother find a birth-mark on the child, the size of a sixpence, and she will wait patiently at the hospital for hours. But in the case of a mild infection of the mucous membranes, with slight pyrexia and a little indigestion, months may pass before an exacerbation, with

sickness.

4) SCHOOL INSPECTION AND SCHOOL CLINICS.

For some years, all school children have been inspected at regular intervals, and provision has been made for the treatment of those found to be defective. There is no doubt that thereby incalculable good has been done, but, from the point of view we are now considering, the inspection of school children may be said to be dealing with late results. School inspection, for example, may show that the teeth are decayed. But the teeth erupted badly because the jaws had not developed properly, and the jaws had not developed properly because the child was a mouth-breather. The mouth-breathing was caused by adenoid vegetations, which in turn were the result of repeated and persistent catarrhs, attributable to the faulty environment of the child. Or else the teeth may have decayed early because their enamel was faulty, as a direct result of the catarrhal state in early childhood, when every epithelial structure suffers severely, when skin, hair, teeth, and nails all show gross changes, as I shall hope to demonstrate at the next lecture. School inspection does great good, and prevents much future ill-health, but, in a sense, it comes too late. The five years of home life such as I have pictured to you, have already done their work. We may, I think, put down the series of changes as follows:—

Firstly.—Life in crowded, airless rooms, with exposure to contact-infections, with lowered powers of resistance, and with a diet of faulty construction, e.g., excess of carbo-hydrate.

Secondly.—Constant catarrhal infection of the mucous membranes.

Thirdly.—Enlargement of all the lymphatic glands and overgrowth of the lymphoid tissue in the body.

Fourthly.—Either a spread of infection through the lymphatic tissue to the blood stream, giving rise to the general infection which we call rheumatism; or, alternately, a further infection with the tubercle bacillus, which lodges and grows more easily in the catarrhal mucous membrane and in the catarrhal gland than in the healthy structures.

Lastly.—We have presented to us the conditions with

VICIOUS CIRCLES IN DISEASE AND NATURE'S EFFORTS TO DEAL WITH THEM.

By F. PARKES WEBER, M.A., M.D., F.R.C.P.

A GREAT deal has been written on the fascinating subject of vicious circles in disease, and how best to break them, or "tap them." I think that, when a vicious circle is actually present or threatening, Nature sometimes, by a great spontaneous effort (crisis), manages to put things fairly straight again. Nature seems still hardly to have received due credit for such spontaneous attempts.

On the other hand, perhaps the real existence of certain alleged vicious circles may be questioned. In one of the best known of Horace's Odes, a vicious circle in disease is described, when the poet alludes to dreadful dropsy (*dirus hydrops*), which, he states, gives rise to a terrible thirst, but in which, the more the patient drinks, the more his body becomes distended with fluid. The passage in question (Horace, Odes, II. ii. 13-16) is as follows:—

Crescit indulgens sibi dirus hydrops,
Nec sitim pellit, nisi causa morbi
Fugerit venis, et aquosus albo
Corpore languor.

We surely do not often come across cases of dropsy of this kind, in which the patient complains of a burning thirst.

Dr. J. B. Hurry, in his admirable paper on "Vicious Circles associated with Disorders of the Blood," says¹: "H. G. Wells has drawn attention to an important circle, frequently associated with cholæmia, caused by obstruction to the outflow of bile. The increase of pigment in the bile renders it more inspissated, and aggravates the obstruction."² In the post-mortem room, however, though one meets with dark inspissated bile in some cardiac and other cases, the gall-bladder and bile ducts generally contain only clear mucous fluid, when for any reason there has been prolonged obstruction to the outflow of bile preceding death. In such cases of chronic obstruction to the outflow of bile, the bilirubin seems to be all absorbed, and to be excreted backwards, through the blood-stream and kidneys, giving rise to the familiar cutaneous pigmentation and the bilious urine

a bout of higher pyrexia, brings her to the hospital, very often in the middle of the night, with a tale of a sudden onset of illness.

No doubt the only cure is to provide suitable housing, but I am confident that, in the meanwhile, we can do much good by regular inspection of the young children in the years in which they are infinitely more sensitive to faults of environment than at a later age. If we can intervene at the outset, when the first departure from normal development takes place, it is often possible to control the infection, and to watch the child regain the power of steadily increasing in weight. Define the normal child as the child that can thrive and grow steadily on a rational diet. There is too much discussion as to what is the *most* rational diet. Of many rational diets everyone wants to recommend his own favourite as being possessed of curative properties which confer health on all babies. The facts are that the uninfected child thrives on all rational diets, while the infected child will, very likely, not thrive on any diet at all, whether rational or not. Systems of diet for children, like systems of diet for adults, are generally chiefly in vogue with people who do not think very deeply.

In my next lecture (which will be published in the September issue of THE PRACTITIONER) I shall deal with the treatment of the individual child, and particularly with the part which diet plays in controlling the susceptibility to catarrhal infection and secondary glandular enlargement.

udations and subcutaneous œdema sometimes occurs by a so-called "urinary or diuretic crisis."

A characteristic example of such a crisis occurred in a young man, aged 20 years, admitted to hospital under my care, on December 7, 1914, in a typically "waterlogged" condition, with ascites, bilateral hydrothorax, and much œdema of the subcutaneous tissues of the lower extremities and trunk. In July, 1914, the patient had contracted primary syphilis, and the case was undoubtedly one of early syphilitic nephritis. In July, 1915, after the "waterlogged" condition had lasted many months, unaffected by treatment, a "diuretic crisis" occurred, the quantity of urine passed during the nine days from July 2 to July 10 inclusive, reaching 2,800 to 4,000 c.c. in the 24 hours, and the subcutaneous œdema rapidly diminished, though the urine still contained much albumen. By the middle of August, 1915, the ascites and the hydrothorax on both sides had completely disappeared, and of the subcutaneous œdema only a little over the sacral region remained, and that soon vanished likewise. Of course, the cutaneous *striae atrophicæ* left by the œdema were very noticeable. In October, the patient was up and able to make himself useful in the ward.⁴

In that case, the rapid disappearance of the dropsy was, certainly, very remarkable, but not more so than it has been in various other cases of prolonged acute nephritis (wrongly called "chronic parenchymatous nephritis") with dropsy of long duration. It seems that in various grave morbid conditions, with or without the influence of special treatment, a *gradual potential recovery* of the organism takes place, and when this process of recovery reaches a certain level, it manifests itself by a *sudden crisis*, at the end of which the organism recovers its functional equilibrium.

Various other cases of rapid disappearance of dropsy by "diuretic crisis" have been published. The term "diuretic crisis" is, I think, preferable to "urinary crisis," for the latter term is apt to be confused with the "bladder crises," etc., of tabes dorsalis. On July 7, 1896, I had a man, aged 28 years, admitted to hospital, suffering from acute nephritis and œdema.⁵ In spite of treatment, the dropsy became excessive, and lasted for many months (a condition often termed one of "chronic parenchymatous nephritis"). At last, about the commencement of March, 1897, the œdematous

of chronic obstructive jaundice (unless the obstruction is only in the cystic duct, so that there is no damming back of bile in the liver).

Nature deals with, or attempts to counteract, the injurious influence of vicious circles in disease in two kinds of way. The first is a *mechanical* or "*explosive*" method, of which spontaneous hæmorrhage, occurring in conditions of polycythæmia and blood-plethora, is a good example. In regard to this method, the physician can often anticipate and imitate Nature with advantage, but in regard to the second or *vital method*, namely, by *crises* of various kinds, the physician can, at most, only assist Nature to bring about and regulate the crises in question. I shall here confine my attention to the following examples of crises.

(a) The well-known *crises of acute infectious diseases*, such as pneumococcal pneumonia. The organism attacked by the disease suddenly breaks through the vicious circle commencing to arise (as the result of the microbic invasion), by overwhelming the invaders or by neutralizing the poisons they produce with substances secreted by its own cells, as the result of a vital reaction.

(b) *Hæmopoietic Crises*.—In cases of chronic anæmia, of various kinds, in which the existence of the vicious circles connected with conditions of chronic anæmia is well-marked, a remarkable improvement or permanent recovery sometimes commences with what may be termed a "*hæmopoietic crisis*." New red corpuscles are rapidly formed in the bone-marrow and "*flood*" the blood-stream, the circulating blood being found to contain large numbers of unripe, nucleated, red cells, which had not been observed on previous examinations. The occurrence of such a hæmopoietic crisis seems to be a true "*vital reaction*," and not directly brought about by any drugs or therapeutic measures, though, doubtless, by suitable treatment the physician can aid Nature.³

(c) *Urinary or Diuretic Crises*.—In cases of so-called "*chronic parenchymatous nephritis*" (really acute nephritis of long duration, one form of "*large white kidney*"), after the patient has remained for many months in an almost helpless, and, apparently, hopeless, "*waterlogged*" condition of general dropsy, passing very little urine (in spite of medical treatment of various kinds), a remarkable and rapid diminution and disappearance of the serous trans-

edemata and subcutaneous oedema sometimes occurs by a so-called "urinary or diuretic crisis."

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distension began to subside, and, within a few weeks, altogether disappeared (by diuretic crisis), leaving innumerable cutaneous "striæ atrophicæ" behind it. The urine, of course, still contained much albumen.

An unpublished case was that of a man, J. J., aged 23 years, under my care in 1905, for acute though long-lasting (often wrongly called "chronic parenchymatous") nephritis. After the patient had been distended with dropsy for nine months, the œdema suddenly disappeared within a week's time. In another case (in 1901), that of a man, H. H., aged 23 years, under the care of my colleague, the late Dr. Fürth, the ascites and œdema, which was not of such long duration as in the preceding cases, suddenly completely disappeared within about three days' time (in that patient the ascitic fluid was slightly milky-like or chyliform).

H. D. Rolleston and J. Attlee⁶ in 1905 recorded a case of "extraordinarily rapid diminution of renal dropsy under citrate of caffeine." A man, aged 36 years, was, from May 10 to June 5, 1905, intensely anasarca; there was ascites and double hydrothorax. The patient lost his œdema and 63 lbs. in weight within 16 days.

In 1909 H. D. Rolleston and F. L. Golla⁷ described the case of an œdematous nephritic man, aged 27 years, who (by what we should prefer to call "diuretic crisis,") lost 59 lbs. in weight within four days coincident with the disappearance of the œdema.

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ACUTE LOCAL PYREXIA.

GALVANOMETRIC DIAGNOSIS AND DIELECTRIC THERAPY.

By J. HORNE WILSON, M.D.

Lecturer to the London County Council.

WHAT is now known as *dielectric* treatment is the outcome of careful and painstaking research in connection with the electrical condition of the body, both in health and disease, by means of a very sensitive galvanometer.

The one I use for this class of work is a Kelvin Astatic, and the sensitivity should be such as to give at least 4,000 millimetres deflection, at a metre, per micro-ampere.

After many months' searching and testing, it has been found that such work cannot be conducted within about a mile of an electric railway or charging station, and the only part of the metropolitan area of London I have found suitable is in the vicinity of St. George's Square, S.W.

The currents from the human body are about $\cdot 004$ volt and $\cdot 01$ mille-ampere.

For a full description of the methods adopted, the experiments carried out, and the conclusions drawn therefrom, I would refer the reader to an article¹ published in THE PRACTITIONER, June, 1914.

The external insulator of the body is the skin, which has not a very high resistance (10,000 ohms), so that there is round every living person a magneto-electrical field. The nerves are insulated only sufficiently to maintain in or on them nerve energy at a certain pressure, and the ganglia are probably a series of storage cells or condensers.

Sign, electromotive force, and current vary in different individuals, resembling thus a galvanic cell, whose terminals, E.M.F., and internal resistance are unknown until tested and ascertained.

In the case of the non-medullated nerves, the high ionization of the axis-cylinder renders it an efficient conductor, even when the dielectric environment is small, and

this is especially the case when the electrical potential is low, as it always is in neuro-electricity.

Goethlin² has shown that the medullary sheath is doubly refracting, very similar to that of liquid crystals of the glycerophosphatides, and that, by polarization methods, the apparently non-medullated fibres of many invertebrates have a sheath of glycerophosphatides.

The presence of the synaptic membrane certainly seems to present some difficulty, and this subject is fully discussed in a most illuminating work, recently published by Professor Bayliss.³

In dealing with the nerve synapse, he states that, in the view advocated by Sherrington, the communication of a nerve impulse to the cell body of another neurone takes place across a membrane, "the synaptic membrane." It is, therefore, owing to the changes in the permeability of this membrane, that impulses are allowed to pass or not, and there is every probability that the ions of the dissociated salts play a large part in the transmission of nerve processes. Reflex action, he says, could be made more explicable, if we could imagine a membrane permeable to certain ions in one direction only, but that irreciprocal permeability is difficult to conceive, and would be possible only in the case of a living membrane to which energy was supplied by cell activity; otherwise, there would be a spontaneous difference of potential kept up between the two sides of the membrane with the possibility of a perpetual motion machine. He considers any explanation to be at present premature.

I would suggest that this energy supplied is the electrical energy obtained from the neuro-electrical currents, the ionic condition of the selecting layer being derived from the neuro-electricity.

Now, although it cannot at present be proved, it may be permissible to suggest, from a purely electrical standpoint, that since neuro-electricity always carries a static as well as a dynamic charge, there may possibly be electromagnetic induction at these points, the same as in the primary and secondary circuits of a transformer, and that such excitation may have some part in the complicated working of the organic economy and in putting various nerve tracts

in sympathetic connection with each other.

The various parts of the body are always in a state of difference in electrical potential, by means of which currents, sufficient to deflect a sensitive galvanometer, can be produced and detected. The brain is the most metabolically active organ in the body, and has, in proportion to its size, a much larger supply of blood than any other organ. Here, too, is the greatest transformation of energy, and as the energy is most probably derived from atomic disintegration, there will be necessarily the production of the largest number of ions, either single or compound. It is this which is the cause of the higher electrical potential which constitutes the electro-motive-force, and this is always supplemented by the constant withdrawal of ions from the circuit as they are used up by the metabolizing cells.

Sir James Mackenzie, in an interesting work⁴ covering new ground, points out in the introduction, how sister sciences, in place of seeking assistance from medicine, look askance at the wild speculations put forth in the name of medical science and that even the atomic theory is now found to be insufficient to explain the newer revelations of science. It is true, indeed, that in science, IONIC or ELECTRONIC chemistry is to-day holding the field.

It is interesting as well to note that, in a recent essay⁵ by one who signs himself "Jadroo," an attempt has been made to show that the body generates electricity. The writer has adopted the view of the "two-solution-cell theory," by means of which a difference of potential may be created and an electric current caused to flow, each cell being in other words a "concentration battery," formed by the fluids within and without the nucleus. I would point out, however, that when two solutions of different salts or the same salt are brought together, there is no electrical current generated, the difference in charge being purely static and not dynamic, and the diffusion of the two solutions is not accompanied by electrical phenonema, except when the stronger solution becomes so dilute by diffusion into the weaker, that atomic disintegration occurs and ionization results.

6 In any cell, whether a single solution is used as an electrolyte, as in a Smee battery, or a double solution and diaphragm, as in a Bunsen or Grove cell, no action (except

a small local one if the elements are not pure) can take place until the circuit is complete, and the same holds true in the organic cells of the body. Much of the cell activity in the body is a dissipation of energy and not a generation of it like the brain cells, which both generate and dissipate, though it is most probable that these are even distinct from each other.

The author makes no attempt to prove by experiment the presence of electricity, which is, certainly, a serious omission.

To-day, we know that atomic disintegration, with the production of ionic groups or free ions, produces a source of energy calculated to be one million times greater than could be obtained from the combustion of an equal weight of carbon and oxygen. The discovery of this unexpected source of energy within the living organism supplies the reason for there having always been found a thermic excess in any computation of the heat balance within the body, founded on the thermal value of combustible materials of the food necessary to keep the weight normal. It seems to indicate as well that there is a function within the living cells, which enables atomic disintegration to be accelerated or retarded, and which is entirely unknown in the inorganic world, where each element has a fixed rate of disintegration. The quantity of energy liberated and transformed by the metabolic changes in the living cells, even in the performance of the necessary mechanical work of the body, apart from any expenditure outside the body, such as muscular exercise, is, when measured in terms of ordinary mechanical units, almost beyond belief. The work done by the heart alone in 24 hours is equal to 120 tons lifted 1 foot high.

In the inorganic world, atomic disintegration is always in the direction of breaking down and simplifying the electronic structure, and never in that of building up into groupings of greater complexity; whereas this does not hold equally in the organic world, in which more complicated electronic forms are elaborated as the result of changes within the plasma of living cells, where the electrons exist as *ions*. Electronic chemistry favours the view that all molecular reactions are, in their ultimate character, *ionic* reactions.

Atomic disintegration and the production of ionic groups or free ions are obtained in a liquid by the influence of

solution. It has been found that, while pure water contains no ions and is therefore a perfect non-conductor, it possesses a remarkable power, when it contains in solution a salt, of splitting up the molecules into ions, and the degree of dissociation of the salt in solution is greater in proportion as the dilution increases ; with a dilution of $\cdot 001$ of a gramme molecule in a litre of water, the salt is almost entirely broken up into ions.

This ionizing property of solution is of particular interest in relation to biological phenomena, because the conduction of neuro-electricity in the nerves and fluids of the body is entirely ionic in nature, and all reactions in the living cells during the production of biogens are between ions and not molecules in the initial stages.

In regard to molecular association, the cause of VALENCY, as well as the reason for its variability in individual cases, is unknown ; there appears, however, to be a growing conviction amongst physicists and chemists that it may be electrical in character. Whether valency is an inherent property of the atom, as an individual, or the result of the interaction of reciprocal forces exerted between combining atoms and molecules, is beyond present knowledge ; but it is this variation in the power of combination of the elements, which renders possible the formation of complex chemical compounds, such as those formed in the organic world. The possession of equivalence in all atomic combinations has a new importance in regard to electronic chemistry, when it is remembered, that if a solution of salts is subjected to the decomposing action of an electric current, the elements or groups liberated by the electrolysis are always in quantitative proportion to their chemical equivalents.

It may be said that equivalent weights of the elements are always associated with equal charges or quantities of electricity ; or, to put it in another way, chemically, weights are also electrically equivalent. It must be noted too that, generally speaking, the lower the electrical potential, of whatever sign, either positive or negative, the greater is the tendency of the molecule to form more complicated combinations. We know that when ions are present in solution, through which no electric current is passing, they are, like the molecules of the water, in constant motion, but the

movements are not in any definite direction, although a definite direction is taken on the passage of an electric current. This knowledge is of importance in looking at the behaviour of the nutrient and other substances within the living cells, because, from the point of electrical conductivity, the fluids may be regarded as ionic solutions.

Ionic reactions take place with great rapidity in water. It is clear that it is only the ions that pass into living cells, and some of them disappear very rapidly. In living cells, we cannot find a trace of potassium by the well-known reaction of platinum chloride; a dead cell, however, at once gives the typical yellow reaction.

The formation of complex ions is very important in metabolism.

Iron salts, for example, are certainly not present as such in living protoplasm, though the presence of iron is always easily shown in the ash. We can see what kind of transformation may be taking place from the reaction of copper sulphate in the presence of organic compounds. Sulphate of copper is immediately precipitated by potassium hydroxide as a light blue gelatinous deposit of hydroxide of copper; when we add sugar solution or a solution of sodium tartrate, this deposit is dissolved into a dark blue liquid. This liquid no longer shows the characteristics of solutions which contain simple ionic copper, therefore copper ions cannot be present. Those present are compound ions containing both copper and the organic substance.

Living cells can even form new ions from non-ionic material. When oxalic acid is formed in plants from sugar or protein matter, new ions of the strong acid come into existence.

So intimate is the connection between electricity and the metabolic changes that occur in the fully ionized cell, that it has actually been found possible to start the process of cell-division in the ovum of the sea-urchin by a simple electro-chemical stimulus.

Recent research by Professor Czapek⁶ has shown that every cell has a plasmatic membrane or selecting layer, and, viewed in the light of ionic reactions, the transference of the substances, which takes place, is governed by the electrical condition of the ionic groups on the two sides of the select-

ing layer. The ions or groups of ions on the protoplasmic membrane determine the character of the material which shall be absorbed, as well as that which shall be protruded from within the cell. The interchange can only take place when the sum of the electrical charges on the two sides are of opposite electrical condition, so that they attract each other. The disappearance of ions within the cell, as a result of metabolic activity, tends always to keep the potential lower on the inner side of the selecting layer.

This may be the cause of the continual difference of sign, since anabolic reactions fix the free ions again into groups, and so the free ions, which are absolutely necessary for the working of the cell, have continually to be replaced by or supplied from the ionized material in the blood. In some cases, it is possible that the rearrangement of the ionic grouping, necessitated by the metabolism, may result in partial atomic disintegration and the liberation of free ions within the cell itself. I shall return to this problem later on in dealing with the cause and origin of local pyrexia.

The thermic reactions which occur in all normal metabolic reactions, are the result of alterations in the molecular structure, and the temperature generated is the difference between the exo- and the endo-thermic results of the change, the temperature rising with the excess of the former over the latter. This is a definite amount, which can be calculated when the exact nature of the change is known; when, however, the cell is generating ions, its reactions are atomic and not molecular, for the ions can be obtained only at the expense of atomic disintegration, when the heat liberated is enormously greater than that arising from molecular change, even if the results are all exothermic.

Professor Bayliss says that it is not possible as yet to explain satisfactorily why changes of permeability of a membrane should give rise to various phenomena, but that further investigation is required, and that it seems probable that a more intimate knowledge of the electrical conditions of the surface of the cell will give valuable information.

Science has so far no explanation of the *MODUS OPERANDI*, except that the reactions are ionic and the results molecular, but it is always associated in the living organism with a

supply of neuro-electricity, either sent direct from the generating centre, the brain, or else liberated from the store accumulated in the ganglia. Whether neuro-electricity is the sole means by which nervous impulses are conveyed from the nerve centres to the working cells, or whether this is associated with a SOMETHING which lies beneath the electro-chemical activity of the conducting fibre or only manifest in living matter, an energy or a directing influence which cannot be repeated by any chemical formula or summed up in any mechanical equivalent, is not yet finally determined.

One thing, however, is certain, that there are conditions which indicate that the electric conductivity and other characteristics are different in a living nerve to the ordinary manifestations in a metallic circuit, and that the nature of the current itself is also different.

Then, when a nerve fibre is stimulated at any point, it evidently acts not only as a conductor, but at the point stimulated there is a charge generated and a current transmitted in both directions, apparently as the result of accumulated energy in the substance of the nerve, and the neuro-electric current, unlike the ordinary current, carries a static as well as a dynamic charge. It acts like a continuous current, where the effects required are obtained by breaking the circuit and not calling the current into play.

TROPHIC INFLUENCE.

Very few works on physiology take any serious notice of the nature of trophic influence on cell metabolism. They are content merely with mentioning one or two outstanding cases of inflammation resulting from the removal of this influence, such as section of the fifth nerve causing corneal inflammation when the eye is exposed, for this does not happen if the eye is kept closed, or the fact that section of the pneumogastric causes vagus pneumonia and gangrene.

Why, in lobar pneumonia, does the inflammation so often confine itself to the whole of one lobe, and not spread to a neighbouring lobe, separated only by a very thin membrane? Why, too, does pneumonia occur so often in strong healthy men under circumstances in which one would not expect a lowered resistance or an overwhelming number

of pneumococci?

Then, again, the fact is noted that acute bed sores follow certain spinal lesions, and that in herpes zoster, post-mortem examination has shown acute inflammatory exudation with small round cells in the corresponding root ganglia.

Noel Paton, in an interesting work,⁷ freely acknowledges this trophic influence is a powerful factor in cell-metabolism, but fails to specify its nature.

Professor Bayliss, on the other hand, is not so willing to accept the fact of trophic influence of nerves on metabolic action. He states, however, that when cells are known to be supplied with nerve fibres, it would be rash to deny the possibility of their being influenced by impulses passing from the fibres to the cells, but that there is no satisfactory proof at present that the nutrition of the tissues is directly affected thereby. In referring to the formation of blisters in herpes, however, he says it seems difficult to believe that mere vascular dilatation should cause the actual formation of blisters, but, at the same time, the possibility has not been disproved.

Now, why should cutting off trophic influence result in acute inflammation? Loss of sensation *per se* is not the cause, for, as in the case of the eye, this merely allows foreign substances to remain for a sufficient length of time to become an exciting cause.

Cell-metabolism breaks down, if this influence is interfered with; which is very readily seen in the application of a very small electric current, say, of one volt, to the skin for any length of time. The patient is quite unable to feel this current, but it alters the IONIC condition of the cells under the terminal. Normal metabolic action becomes arrested, and the tissues become inflamed and ulcerate, causing a troublesome sore, which is particularly slow in healing. X-ray and radium burns, too, are due to the effects of over-ionization.

What, then, is the nature of this so-called trophic influence?

Formerly, it was thought that cell-metabolism was the result of simple osmotic action, such as occurs through the membrane of a dialyser, or it was explained as the result of surface-tension between the plasma within the cell and the fluid that lay without it. The factor of filtration, due

supply of neuro-electricity, either sent direct from the -generating centre, the brain, or else liberated from the store accumulated in the ganglia. Whether neuro-electricity is the sole means by which nervous impulses are conveyed from the nerve centres to the working cells, or whether this is associated with a SOMETHING which lies beneath the electro-chemical activity of the conducting fibre or only manifest in living matter, an energy or a directing influence which cannot be repeated by any chemical formula or summed up in any mechanical equivalent, is not yet finally determined.

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Without this influence, no living cell can perform its metabolic functions, because it ceases to be able either to take in sufficient nutriment or extrude completely the waste products of the metabolic change.

It is not, however, generally known that this controlling action of the nerves is due to neuro-electrical energy which keeps the cell contents ionized. Without this no metabolic action is possible, nor the selective absorption (adsorption), which is necessitated by the specific requirements of the cells in the various organs of the body, to enable them to form the particular biogens required by the organ, whether they be reproductive, secretive, or excretive.

It is not at present known whether the electric manifestations, always associated with every form of nervous influence, whether motor, acceleratory, inhibitory, secretory, or trophic, are purely electrical, or only concurrent and simultaneous with some form of energy at present unknown to us. It is certain that neuro-electricity differs from all forms of electricity which can be generated either chemically or dynamically, since it possesses the power to charge nervous ganglia, which act as stores of neuro-energy required as auxiliary to the constant brain current, and are able to be called into action as required, either automatically or voluntarily, as the case may be.

While living cells in the body under nervous control, act collectively as a whole, they also act severally and individually as separate units, and perform their various functions as if entirely isolated from each other. Each cell is, in fact, a separate laboratory in which nutrient material is being ceaselessly decomposed and recomposed into the biogens which it individually requires in the performance of its function; whilst concurrently, the waste products resulting from the metabolism are constantly being extruded.

It is because of this dual action in each individual cell that local pyrexia is possible. As already shown, the cause of absorption and extrusion of the plasmic contents of the cell is not the result of simple osmotic action, like the transference through the membrane of a dialyser, or a difference in surface tension alone; in addition to this, the action is further governed by the electrical condition

to difference of mechanical pressure, plays a certain part, but most physiologists at the present time confess that there must be some other vital force at work, which often acts so as to interfere with or oppose the action of osmosis, filtration, and surface tension.

This is discussed in a recent philosophic work⁸ by Dr. Johnstone. In dealing with this vital impetus, the writer draws two main conclusions:—

- (1) That physiology encourages no notions as to a "vital principle," force, or form of energy peculiar to the organism.
- (2) That although physiological analysis resolves the metabolism of the plant and animal body into physico-chemical reactions, yet the direction taken by these is not that taken by corresponding reactions occurring in inorganic materials.

From these two main conclusions, he adds, we have therefore to construct a conception of the organism, which shall be other than that of a physico-chemical mechanism.

Professor Halliburton⁹ says we have undoubtedly some other force or manifestation of force in the case of living membranes, and that it is probably some physical or chemical property of living matter, which has not yet been brought into line with the known chemical and physical forces which operate in the inorganic world. We cannot deny its existence, for it sometimes operates so as to neutralize the known forces of osmosis and filtration. With regard to absorption from the bowel, he points out that Waymouth Reid has shown that if the living epithelium of the intestine is removed, absorption comes very nearly to a standstill, although from the purely physical standpoint, removal of the thick columnar epithelium would increase the facilities for osmosis and filtration.

This new, so-called vital factor (vital in the sense that it can act only where there is life) is, therefore, a condition of electrical attraction, dependent on the electrical condition which has been shown to be present in all living things.

THE CAUSE AND ORIGIN OF LOCAL PYREXIA.

It is now known that trophic nerves control the nutrition of those parts of the organism which they supply.

the cause. But why do they disrupt so much more rapidly in organic than in inorganic nature, where centuries are reduced to seconds?

The chemical composition of the selecting layer assists in the dialysing action during absorption, and the mutual repulsion of the negative ions within the cell favours the extrusion of the waste products. Only negative ions are ever rendered free within the cell, because the positive ion or ions, which are always of molecular proportions, are always retained as essential to the formation of a biogen, and, being less numerous if entirely uncombined during the metabolic change, are instantly re-combined in the new product. The result of this high negative potential in the plasma, containing the waste materials in solution, assists in their extrusion and removal into the venous or lymphatic circulation, as the case may be.

When the cell is duly supplied with neural energy, the intrusion and extrusion of cell-contents keep the quantity of the cell-contents and the temperature constant. If, however, from any cause, this trophic influence is disturbed, then the balance between absorption and extrusion is interfered with, and a serious alteration occurs in the condition within the cell.

When acting normally, the chemical changes within the cell, arising from the oxidation of some of the nutrient material, generate heat, which supplements that derived from the oxidation of the waste material in the lungs, and thus increases the general heat, of the body. The degree of heat within the cell will be the result of the difference between the sum of the exo- and endo-thermal results of the metabolic changes, increased by the heat arising from the atomic disintegration. The amount of this will be determined by the number of free ions liberated during the reactions, which is always a million times greater in proportion to the weight of the matter undergoing change, than if the reactions were molecular, as in ordinary chemical combination giving exothermic results.

Unless, therefore, there was a provision to regulate this cell-generation of heat, there would be a rapid and serious rise in temperature. The regulating power, which keeps the temperature normal and constant, will easily be under-

of the plasmic contents without and within the cell. No nutrient material can enter a living cell, except in a liquid form and in an ionized condition. All substances in solution are more or less ionized, and the greater the dilution, the more ionized the condition.

The material outside the cell is usually in a POSITIVE state electrically, and that within the cell, as the result of the metabolic changes which liberate free ions, is always NEGATIVE, so that an attraction exists between them. All fully saturated colloids are electrically either neutral or positive. Even the neutral ones become positive as soon as they begin to change, because a positive condition is the first stage in any reaction with a neutral; it probably loses at once one electron in the atomic group, and an excess of free electrons is always negative, since all free electrons are negative.

The negative condition, as the result of metabolic change, arises from the fact that in the re-arrangement of the ionic groups, necessitated by the new grouping in the formed biogens, there is probably always a certain number of parallel phenomena or un-used negative electrons, the positive companions of which were required for the higher atomic bodies and so they were left free.

Neuro-electricity is the exciting cause of the metabolic activity, and the change in sign, from positive outside to negative inside, is the result of the new atomic arrangements within the cell not requiring the whole of the electronic groupings in the new combinations, with the necessary result of unused single electrons, which are always negative.

I cannot myself understand the cause of the action of the selecting layer in the cell membrane, which is the cause of *adsorption* (selective absorption) unless in one case it is the result of electronic groups and in the other of single electrons.

Though Professor Bayliss attempts to explain all the changes as the result of physical laws, he does not point out any cause for this action, which is the crux of the whole matter.

Neuro-electricity is only a regulated stream of electrons or ions, and it is the energy of the disintegrating atoms and that which they liberate on disruption which may permit

nerve-sheaths in the inflamed area, as is demonstrated by the fact that there is a rapid off-scale deflection over the region thus affected or, in other words, there is a leak or escape of nerve-energy. From the standpoint of an electrician, temperature means a breakdown of local insulation resistance; in other words, local pyrexia is a shunt of varying resistance.

This condition may be due to the effect of toxins on the nerve-sheath, increased by the local rise of temperature, causing a decrease of the insulation resistance of the sheath, the nerves being insulated only sufficiently to retain a current of a certain pressure or potential. Or, the primary cause may be due to some condition causing an increased resistance in the axis-cylinder, and thus diminishing the trophic influence; the limited local site of the inflamed area in lobar pneumonia would suggest this.

It was this discovery of the electro-pathology of acute inflammation that led up to dielectric treatment. It was presumed, from an electrical point of view, that if this leak or escape of energy from the nerves, due to faulty insulation, could be stopped, then this energy or trophic influence would be restored to the tissues. Experiments were made with liquid dielectrics or non-conductors, which had the property of penetration, and these led to surprising results from a therapeutic point of view. Liquid paraffin, as I have mentioned in other papers, may be made to suit these requirements, and when so prepared is known as dielectric oil. The chief points in its preparation are the specific gravity, viscosity, and an absolute chemical and electrical purity, as detected by ultra-analysis and micro-spectroscopic absorption bands. The greater the freedom from free or foreign ions, the higher is its electrical resistance. It ought to be tasteless, colourless, odourless, and free from the slightest suspicion of bloom.

THE APPLICATION OF THE DIELECTRIC.

In acute inflammation, the sooner the dielectric oil is applied the more prompt will be the result, because if one waits till the cells in the inflamed area have swollen so that they rupture and die, it will take longer to obtain the

stood, if each cell is considered as a vessel entirely filled with liquid contents. If it was a vessel filled with water and subjected to any source of heat, it is clear that whatever the temperature of the source of heat may be, the liquid in the vessel can be maintained at a constant selected temperature, provided that a quantity of the heated liquid is always drawn off, and replaced by running in sufficient of the liquid at a lower temperature. The quantity to be drawn off and the quantity replaced in a given time depends on the quantity and temperature of the flame or source of heat. The supply drawn off and replaced will be more rapid in proportion as the source of heat is greater or less.

This is just what occurs in a living cell; the nutrient material fed into the cell at the temperature of the blood is exactly counterbalanced by the cell plasma, containing the products of the metabolic action, being drawn off. This constant exchange is greater or less, in proportion to the metabolic activity of each particular cell. When the trophic neural energy is interfered with, the change of sign in the contents within the cell is less rapid, so that the heated cell-contents remain longer within the cell, and therefore rise in temperature, because less of the cooler nutriment is being fed in.

In addition, the rise in temperature increases the volume, and puts a greater pressure on the cell-wall, which further retards the intrusion, and so causes a further rise in temperature; local pyrexia therefore ensues. This tends to increase indefinitely, and forms a centre of inflammation, which, unless checked, will spread and increase in intensity. Further, as the temperature rises, the cell-contents swell, accompanied not infrequently by partial coagulation of the albuminoid contents. When a certain point is reached, there may be rupture of the cell-wall, with destruction of the contents. If by any means, however, the trophic influence is restored to the cells in which local pyrexia has occurred, the unruptured cells rapidly regain their normal metabolic activity, the inflammation ceases, and the destroyed cells are absorbed or replaced.

Now, galvanometric examination has shown that there is a breakdown of the local insulation resistance of the

soaking it, if it tends to get dry. Generally, it is found that within 12 hours the temperature has come down to normal, or nearly so, with a corresponding improvement in the clinical symptoms.

In all cases, however, in order to obtain the best results, it is necessary to give a tablespoonful of the oil by the mouth every four hours, for three to four doses, in an adult, and to children in proportion. By doing this, the necessity for giving any other drug as a laxative is avoided.

In acute uncomplicated appendicitis, I advise two ounces to be given at once and repeated in 12 hours, as well as the local application of the oil over the whole of the front of the abdomen.

Again I would emphasize the importance of its application at the earliest possible moment, and of not waiting till all other remedies have been tried and the patient is moribund. I have known of cases of pneumonia, in which its application has been left until too late, for although the temperature was brought down, the condition of the lung, resulting from the acute inflammation, was such as to cause the death of the patient.

It need scarcely be pointed out that in all such cases of acute local pyrexia, in fact, in nearly all the acute diseases ending with the termination "itis," a galvanometric examination is quite unnecessary, as well as generally impossible. There is, however, one clinical point I would refer to again, which is, that if there is more than one area of acute inflammation, each must be treated. I have seen cases of bronchopneumonia in children, in which the treatment failed to bring down the temperature, because of the failure to treat an acute tonsillitis which was present as well; when this was done subsequently, the temperature came rapidly to normal.

Before giving the following few clinical examples, I would refer the reader to an article by Dr. Leonard Williams, written in his own inimitable style, which appeared in *THE PRACTITIONER*, April, 1916, under the heading "Common Aids."

CASE 1.—Double lobar pneumonia; 8

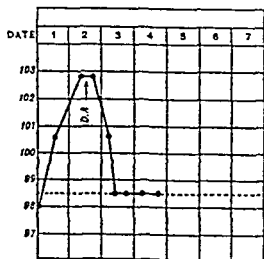


FIG. 1.

absorption and expulsion of the dead elements, with a corresponding delay in the improvement in the clinical signs.

Another very important point to bear in mind is that no drugs of any kind, especially acids, alkalies, and salines, should be given either immediately before or during treatment, for these will interfere with the penetration as well as with the dielectric action of the oil. The reaction of the perspiration is acid, due to acid sodium phosphate, though in profuse sweating it may be alkaline or neutral, and many drugs (sudorifics) increase the amount of the perspiration, while others, such as quinine, iodine, and compounds of arsenic and mercury, are capable of reappearing in the sweat, when administered internally. These, when in contact with the oil, have the power of ionizing it, and thus making it no longer a reliable dielectric or non-conductor. For the same reason, no acid drinks, such as lemon, or any *fruit* should be given, except, perhaps, bananas.

The whole of the inflamed area or areas must be covered by the oil, which is best applied by soaking good non-medicated, absorbent wool, from $\frac{1}{4}$ to $\frac{1}{2}$ an inch thick, with the oil. The saturation must be thorough, and the wool should be an even grey colour, showing no white unsaturated fibres. The oil must on no account be heated, for the resistance co-efficient is decreased by rise in temperature, and in dangerous cases, with hyperpyrexia, it is better to stand the bottle, containing the oil, in ice for fifteen minutes before applying it.

The saturated layer of cotton wool having been placed in the proper position, it is then covered with a larger layer of jaconet or oil-silk. It should have a margin of at least three inches beyond the wool which it covers, and outside this is placed a still larger layer of Gamgee tissue, which will absorb any oil that escapes, and thus prevent soiling of the clothes and bed linen. The whole is then securely fixed by bandages or tapes, and the patient should lie as horizontally as possible, owing to the tendency of the oil to gravitate to the lower part of the application.

A pneumonia-jacket of good quality wool, which may be soaked in the oil, is often more convenient in pulmonary cases. This dressing is left on for from 24 to 48 hours, re-

the temperature had come down to normal, and the redness had almost gone, though the swelling remained till the next day, the wound healing in a day or two without any further trouble.

I have seen many cases of acute tonsillitis, acute pharyngitis, and acutely inflamed piles entirely relieved from pain and temperature overnight by dielectric treatment.

I have also seen severe sprains entirely relieved of all pain and swelling by its application over night, with the result that they have been able to use the joint the following day.

Space does not allow me to enter here into its application to wounds, to prevent the onset of inflammation as well as to arrest it when it has already occurred, and I have already dealt with this problem elsewhere.¹⁰

GALVANOMETRIC EXAMINATION AND DIAGNOSIS.

During the last three years I have been investigating the electrical condition in a large number of diseases, and the results of the investigation in many obscure nervous conditions have been very instructive, while the effect of dielectric treatment has often been most striking. As will be seen from the cases I give further on, such an examination is necessary before the treatment can be applied.

The routine I generally adopt is, first to see that there is no steel or iron about the patient, then the clothes are removed to the waist, and a gown is put on fastening at the back, so as to leave the spine free for examination. The hands are then washed and dried, all rings being removed, and the patient is then "earthed" by holding a copper rod connected with an earth plate for a few minutes. The hand-to-hand deflections are now taken, in order to ascertain the electrical potential and sign of the patient, by holding the silver electrodes lightly in the two hands. Normally, a deflection of the light on the scale takes place, either to the right (+) or to the left (-) side, reaching to about 350 mm. and remains there, but on changing the hands on the electrodes there is always a reversal of the sign.

The great majority of people in health give positive deflections (to the right) on holding the right terminal of the galvanometer in the right hand, but I have noticed that all cases of rheumatism give strongly negative deflections. It

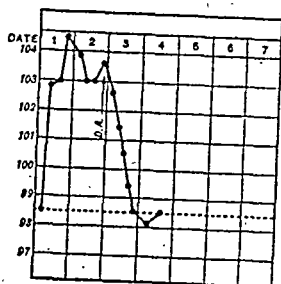


FIG. 2.

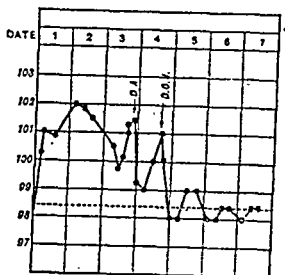


FIG. 3.

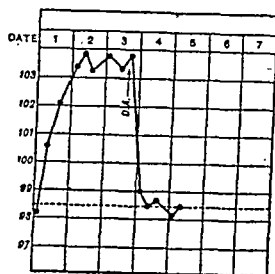


FIG. 4.

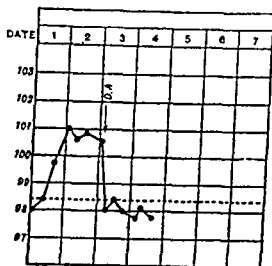


FIG. 5.

months pregnant. Age 28. Reported by Dr. Alec Flett. Treated on second day, and on the day following the incessant cough and pain in side had gone, whilst the temperature rapidly fell to normal and remained so. There was no miscarriage.

CASE 2. — Acute broncho-pneumonia. Child $1\frac{1}{2}$ years. Child very ill for two days with temperature 103 to 104. Mother consumptive, living in basement, but was able to take the temperature every four hours correctly. Within 12 hours temperature came down to $99^{\circ}4$, and a few hours later was normal and remained so. Child made an excellent recovery.

CASE 3. — Acute broncho-pneumonia. Very delicate girl, 9 years old. Reported by Dr. R. C. Watson, Tunbridge Wells. Child had been seriously ill for several days when the dielectric treatment was applied externally. The temperature began to fall, but rose again next afternoon, when the oil was given internally as well, and the following day it rose only to 99° and then never rose above $98^{\circ}4$. The child made a good recovery.

CASE 4. — Acute erysipelas of arm and shoulder. Man, age 40. On second day and third day the patient was often delirious. There was marked redness, with induration and swelling of the arm. Within four hours of the application of the dielectric, the temperature fell from $103^{\circ}8$ to 99° , with a complete absence of pain and redness, though the induration remained for a few days. The patient was able to get up within 24 hours, and his appetite had returned.

CASE 5. — Acute cellulitis of hand and arm, following a wound in the thumb within 24 hours. The hand and part of the forearm were intensely red, swollen, and very painful, and the wound itself was inflamed. The patient felt ill, and the temperature ranged between 100° and 101° . The whole hand and arm was covered with cotton-wool saturated with the oil. Within four hours, all the pain had gone,

unfit. The unconscious attacks sometimes lasted an hour, and he was generally aware of their onset. Pulse was only 40, which he states it had been for several years. There was no abnormality of any of the reflexes, but he had slight facial spasm, his speech was slow and sluggish, and he complained of cold extremities and of being very easily tired. Galvanometric examination.—Hand to hand deflections = 180, positive. There was an off-scale deflection from both the upper and lower right cervical sympathetic. The dielectric oil was applied to these areas, where there was an escape of energy, for 14 days, and he was re-tested a week later and no off-scale deflections were obtained. His pulse had risen to 70, his speech was normal, and he stated that he felt quite well again. There has been no further attack, save one, which occurred, when on one occasion, he developed a large swelling in his neck, which was said to contain cholesterin. For the past year, he has been engaged in strenuous Army work in Scotland.

CASE 2.—*Angina pectoris and asthma*.—Captain —, age 47, invalided home from India a few years ago. Complains of shortness of breath and attacks of angina. Galvanometric examination revealed an off-scale deflection over the course of the left vagus in neck. Dielectric treatment was applied for a week, at the end of which time he wrote me from Scotland, saying his breathlessness had disappeared, and that he was now able to take long walks without the least fatigue. Since then he joined the Army, and remained perfectly well for a year, when he developed a severe influenza, and the shortness of breath and the asthma returned. He was treated by the Army Medical Officers and sent to the Isle of Wight, but with no improvement.

I then tested him again and found a similar condition of the right vagus. He then applied the dielectric treatment, and within three days he wrote me, from the country, saying he was able to motor and walk for miles without any inconvenience, and has been back in the Army now for some months, feeling perfectly well.

CASE 3.—*Neurasthenia*.—Miss —, age 36, was brought to me February, 1915, complaining of feeling exceedingly nervous for years, with fainting attacks and very readily getting exhausted. During the galvanometric examination, the patient had a fainting attack, and I found a very marked escape of energy from the whole of the spine and the front of the abdomen. The treatment was carried out at night for six weeks; she has regained energy, and lost all the fainting attacks and the nervous condition.

CASE 4.—*Dysmenorrhœa*.—Miss —, age 30, very severe pain at periods, which come on every two to three weeks, pain as well over right ovary and in back and down right thigh, often unable to put the heel to the ground. Galvanometric examination revealed rapid off-scale deflections from the 1st to 4th lumbar vertebræ, and over the lower cervical sympathetic on both sides. Dielectric treatment applied for 14 days; the next period was painless, and came on in

is interesting to note that if a magnet is applied to the left side of the body, the patient becomes strongly positive, and this may have some connection with the supposed effect of a magnetic ring in such cases.

In typical neurasthenia, the hand-to-hand deflections are always feeble and constantly varying in sign to both sides of zero, both negative and positive.

I then examine the whole of the spine and the various sympathetic ganglionic centres, especially the cervical, not forgetting also the course of the vagus nerve; then, with the patient lying on a couch, I examine the whole of the front of the chest and abdomen in a similar manner. During both these examinations, the patient is connected to one terminal of the galvanometer by a head contact or electrode, attached to the centre of the brow, and the other terminal is attached to a suitable-sized electrode with ebonite handle, by which the currents from various parts of the body are deflected. Normally, such deflections should not be more than about 150 mm., but wherever there is faulty insulation, there is a rapid off-scale deflection. I have often noticed that over the sympathetic the light goes more slowly, though it still goes off scale. These areas are carefully noted, and the application of dielectric treatment for a fortnight or three weeks, very often at night only, has been found sufficient to stop the leak by temporarily insulating the nerves by its dielectric action. The over-ionizing of the sheath, which occurs owing to the escape of the neuro-electricity from the axis-cylinder, is thus prevented, and as long as this over-ionization takes place, it is impossible for the sheath-cells to form their normal insulating substance. That this has actually happened can be proved by subsequent galvanometric examination, which I generally advise about a week after the last application of the dielectric.

It follows, that if these leaks are the cause of the nervous symptoms, generally very obscure, their prevention, by this method of treatment, results in the disappearance of those symptoms, as the following few cases will show.

CASE I.—*Supposed epilepsy.*—In October, 1914, Captain —, age 40, was brought to me by Dr. E. W. Martin. He gave a history of epileptiform attacks during the past 12 years, and had had sunstroke in 1901. Five years ago, he retired from the Army as permanently

sobbed in his sleep, had terrifying dreams, and began to stammer and jump at sudden noise.

He was discharged from one of the military hospitals for two months, and then tried baths and electric treatment at Leamington, which made him worse. It is interesting to note that he mentions that he has felt ill and depressed in thunderstorms, but not so when he was wearing rubber boots. He had lost over a stone in weight.

Galvanometric examination showed his hand to hand deflections to be only 90 mm. positive, instead of the normal 350 mm. There were rapid off-scale deflections from the whole of the spine and the whole of the abdomen, both back and front.

The dielectric oil was applied to these areas, day and night, for a week, and at night only for another week. He was retested a week later, when no leaks were found at all, and he was then sleeping eight hours on end, was bright and cheerful, having lost all the nervous symptoms of which he complained, and was anxious to get back to active service. I retested him after being two months on duty and found no escape of nerve energy. He reports himself perfectly well and felt no depression during a recent thunderstorm.

Such cases are, unfortunately, numerous, and the loss and expense to the country must be considerable. I cannot but express very strongly the conviction, that, if such measures were taken early, there would be a great saving of both men and money.

In conclusion, I should like to show by actual tests that when a nerve is functioning it carries something which we term "Neuro-electricity," capable of being detected and measured by a galvanometer, and when there is a loss of function, either partial or complete, there is found to be a deficiency or absence of this current from the area supplied.

I am not alone in this opinion, as other medical men who have adopted this method of diagnosis have got the same result.¹¹

Below I give the result, after very careful galvanometric tests, of two cases of nerve lesion, one a case of ulnar neuritis due to a marked increase of the resistance of the axis cylinder, and not to a breakdown of the local insulation resistance of the nerve sheath as is found in many cases, manifesting itself by a rapid off-scale deflection; the other is an injury to the median and ulnar nerves by a bullet entering the right arm above the elbow.

CASE 1.—*Right Ulnar Neuritis*.—Patient complains of tingling and numbness in the area supplied by the nerve from the wrist to the tips

exactly 28 days. All the other pains have gone.

CASE 5.—*Severe pain in chest every morning (pseudo-angina).*—Dr. —, age 42, has complained for a year of a severe pain in the chest on the right side, coming on nearly every morning about 10 a.m. It made him feel very nervous, with a feeling of dread, and nothing seemed to improve matters. Galvanometric examination revealed a leak over the lumbar spines, and over the course of the right vagus in the neck. Treatment was applied to both areas for a month, and on retesting the leaks were shown to be stopped. He has now been free from the pain for several months.

SHELL SHOCK AND CONCUSSION NEURASTHENIA.

I am convinced that a complete galvanometric examination of these cases would place the treatment on scientific lines, and the resulting treatment would afford many patients a rapid means of cure.

In a paper "War Wounds and Other Injuries,"¹⁰ I pointed out that it is a mistake to look for gross anatomical lesions in the majority of these cases. I have, unfortunately, not yet been able to get them at an early stage, for those I have had, have been drifting under various methods of treatment, till most of them had nearly drifted out of the army altogether; on account of their condition.

I will conclude by giving two examples, the first a slight and a comparatively early case, and the other the reverse:—

CASE 1.—Captain —, engaged in testing big guns, consulted me in August, 1915, complaining of nervousness and fainting attacks, with queer feelings in his head and a sense of loss of control of the right leg, for some months, and he was concerned lest he should have to give up his work. Galvanometric examination revealed rapid off-scale deflections from the whole of the spine, but nowhere else. Dielectric treatment was applied to the spine every night for a fortnight, and on retesting, a week later, the leaks were found to be stopped, and he reported that he had lost the feeling of nervousness and inability to concentrate, as well as the other symptoms of which he complained. Recently I heard that the improvement had been maintained.

CASE 2.—Captain — was twice knocked over by shell explosion in November, 1915. He then complained of pains in his limbs and insomnia, and was sent back to England about the middle of December. He was then very depressed, shrieked, walked and

sobbed in his sleep, had terrifying dreams, and began to stammer and jump at sudden noise.

He was discharged from one of the military hospitals for two months, and then tried baths and electric treatment at Leamington, which made him worse. It is interesting to note that he mentions that he has felt ill and depressed in thunderstorms, but not so when he was wearing rubber boots. He had lost over a stone in weight.

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CASE 1.—*Right Ulnar Neuritis*.—Patient complains of tingling and numbness in the area supplied by the nerve from the wrist to the tips

of the fingers. The figures indicate millimetres on the scale.

	Right.	Left.
Tip of little finger - - -	120	380
Tip of third finger:		
Ulnar side - - -	120	380
Radial side - - -	380	380
Tip of second finger - - -	380	380
Tip of first finger - - -	380	380
Tip of thumb - - -	380	380
Hypothenar eminence - - -	120	300
Thenar eminence - - -	300	300
Ulnar nerve in wrist - - -	120	300
Radial nerve in wrist - - -	300	300

CASE 2.—*Partial Paralysis of Median and Ulnar Nerves of Right Hand owing to a Bullet Wound in September, 1914.*—Nerve suture done a month later, but result not very satisfactory, owing to contraction of the muscles. There is diminished sensation over the whole hand, and only partial return of power, the thumb having recovered most completely.

	Right.	Left.
Tip of thumb - - -	300	380
First finger - - -	40	380
Second finger - - -	40	380
Third finger - - -	40	380
Fourth finger - - -	40	380
Thenar eminence - - -	300	380
Hypothenar eminence - - -	40	380

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DERMATITIS DUE TO HAIR-DYES.

By J. L. BUNCH, M.D., D.Sc., M.R.C.P.

Physician to the Hospital for Skin Diseases, Leicester Square; Physician for Skin Diseases to the Queen's Hospital for Children.

It is a fact that most of the hair-lotions and hair-tonics which are so extensively prescribed, so largely advertised, and so universally sold, are not in the least injurious. Some of them are even occasionally successful, but others, unfortunately, are not merely innocuous. For instance, resorcin, which is so largely ordered by dermatologists for seborrhœa of the scalp and hair falling out, can cause, when injudiciously applied to the skin in doses excessive for the individual, not merely injury, but even death.

Boeck, of Norway, in the *Norsk Magazin for Lægevidensk.*, a Scandinavian journal, reports such a case, but says that he has been able to discover only three similar cases of poisoning by the external use of resorcin in the whole of medical literature. One of these was a fatal case, occurring in an infant of 11 days, with pemphigus neonatorum; the other two were non-fatal, one being in a man, aged 29, with widespread lupus vulgaris, and the other in a man, aged 19 years, with seborrhœic eczema on the trunk and limbs.

Boeck's own case was that of a boy, aged 16, with extensive lupus vulgaris, which was first treated by Finsen light, and, later, by resorcin. This was applied in the form of a 30 per cent. resorcin paste, and fifteen minutes after the application of the dressing the boy began to be restless and to complain of pain, which increased in severity. He became quieter, and about an hour later was found to be unconscious, cyanotic, and showed spasmodic, jerky movements of the right arm. Pulse, 120. He then developed clonic convulsions and Cheyne-Stokes breathing. Coma followed, turning into death, which resulted nine and three-quarter hours after the application of the paste. The autopsy revealed pronounced œdema of the brain, and this was considered sufficient to account for all the symptoms.

Several cases have recently come under my care of severe

dermatitis, caused by the application of hair-dyes. In most cases, the dermatitis is preceded by itching, frequently severe, but occasionally the skin-lesions are not heralded by any such subjective sensations. The scalp and face are most frequently affected, the skin becoming markedly erythematous, with a feeling of intense burning, followed by the appearance of numerous vesicles, which become confluent and give the appearance of a "weeping" eczema. In severe cases, the whole of the face becomes red and œdematous, the eyelids especially swell up so that the eyes are practically closed, and the inflammation may extend down the neck to the chest and back. In such cases, the skin remains red and inflamed for days, and only assumes a normal appearance again when the direct effect of the irritant has passed off, and soothing lotions or creams have been applied.

When such inflammatory symptoms have followed the first application to the scalp of any dye, it is probable that a definite idiosyncrasy exists in that patient to some chemical substance contained in that particular dye, and also, as a rule, to similar allied chemical compounds when applied externally in sufficient strength. But sometimes no evil consequences result from the first or second application of the dye, and it is only after several successive applications that the scalp becomes inflamed, and the previously mentioned symptoms of dermatitis result. In such cases the idiosyncrasy is evidently less marked, and the probability of anaphylaxis arises. It is, indeed, difficult to explain such cases on another supposition, if the intervals between the successive applications of the dye are sufficiently long. Patients who have previously suffered from any acute dermatitis are naturally more predisposed than others to react to any external chemical irritant, and it is in such individuals that hair-dyes most frequently produce untoward results.

Although these inflammatory reactions are most frequently the sequelæ of applications of paraphenylene or para-amido bases, made from an aniline, or an alkali-phenol derivative, they not infrequently result as well from a dye made from a metallic salt, especially when combined with pyrogallol or nitric acid. These dyes are, as a rule, made from a salt of lead, mercury, bismuth, or silver, and a second solution, used after the first has thoroughly penetrated, and

applied also to the hairs and hair-roots, contains sodium sulphite or pyrogallie acid, or some oxidizing or reducing agent. Much less harmful dyes are the so-called "progressive" hair-dyes, such as the well-known combination of a solution containing lead-acetate in rose-water, with free sulphur, which colours the hair and discolours the scalp—and the pillow—after several applications. A similar dye, frequently used, is a paste made of henna and other substances, applied for a couple of hours to the scalp, at a temperature of 45° C., under compresses of cotton-wool maintained at a similar temperature. The tint obtained by the application, for two hours, of such a poultice becomes very much darker in a day or two by oxidation in the air, but the hair coloration is rarely equal, and the client, whose hair has been thus treated, has a tendency to become restive and seek some other more satisfactory method.

A more rapid and equally innocuous dye is a tincture, or ointment, containing walnut-juice, and this can be adapted to a considerable range of tints, short of black, but it has the disadvantage of not being permanent, and of not resisting, in most cases, the devastating effects of a soap shampoo.

But such dyes are much less satisfactory to the average patient than the instantaneous, and, for a time, permanent dyes, such as paraphenylene-diamene and para-amidophenol. In spite of the possible dangers attaching to the use of such substances, these are the dyes most extensively employed by professional coiffeurs, not only because the required tint can be obtained in the comparatively short period of three-quarters of an hour, but also because the gamut of tints is practically unlimited, and a thoroughly natural restoration of the hair colouring before the client departs can be absolutely assured. Whether the hair has to be dyed the darkest black, or the lightest blonde, or any intermediate tint of auburn or brown, this can be done with certainty by a solution of paraphenylene-diamene or para-amidophenol, using the former more especially for the darker tints, and the latter for tints varying from auburn to very light blonde. Moreover, the staining of the hairs by means of these dyes is very thorough, and penetrates not only from without inwards, as far as Huxley's sheath, but also colours, although not so deeply, the medulla. On the other hand, vegetable dyes,

dermatitis, caused by the application of hair-dyes. In most cases, the dermatitis is preceded by itching, frequently severe, but occasionally the skin-lesions are not heralded by any such subjective sensations. The scalp and face are most frequently affected, the skin becoming markedly erythematous, with a feeling of intense burning, followed by the appearance of numerous vesicles, which become confluent and give the appearance of a "weeping" eczema. In severe cases, the whole of the face becomes red and œdematous, the eyelids especially swell up so that the eyes are practically closed, and the inflammation may extend down the neck to the chest and back. In such cases, the skin remains red and inflamed for days, and only assumes a normal appearance again when the direct effect of the irritant has passed off, and soothing lotions or creams have been applied.

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not always to the owner's profit. A recent law case may be recalled, where damages were given against the proprietors of a hair-dye, because it stained the purchaser's hair a magenta colour—quite apart from the question of associated dermatitis.

The toxæmic substance, in the case of paraphenylenediamine, is chinondichlordiamine, a by-product of its oxidation. This substance has been shown, experimentally, to be a violent irritant, and it is undoubtedly an intermediate stage in the oxidation of paraphenylenediamine to its harmless and non-irritant product. But chinondiamine not only polymerizes very easily, but also combines readily with other chemical substances, as well as with the final end product previously mentioned, so that it is difficult to prove that the inflammatory symptoms produced are not, in some cases at least, due to derivatives, or chemical compounds of chinondiamine. On the other hand, the chinon compound can be oxidized by the addition of sodium bicarbonate or transformed by the addition of sodium sulphite into a sulphur compound, both innocuous, and yet a solution of paraphenylenediamine, treated by such means, may, in some predisposed individuals, still cause well-marked inflammation. So that it appears as if other substances than chinondiamine, produced during the oxidation of paraphenylenediamine, can also have well-marked irritant effects, although perhaps less frequently.

The final non-irritant substance produced by the oxidation of paraphenylenediamine is called Bandrowski's base, and it is to this that the darkening effect of the dye is due.

One factor in the rapid production of inflammatory symptoms after the use of this dye is the permeability of the skin. This is, to a certain extent, increased by the use of hydrogen peroxide, which has a mordant effect, not only on the hair, but probably too on the epidermis of the scalp. Then again, in women who dye their own hair—and many do—incomplete or neglected shampooing afterwards is made more dangerous by a mass of more or less thick hair, heaped up over the scalp, and acting as a sort of compress or non-conductor.

These cutaneous symptoms are, as already stated, due to chinondiamine, its polymers, or derivatives; but still more severe systemic effects may be produced by absorption of pure phenylene diamine. These are giddiness, tinnitus, clonic and tonic contractions, and gastro-intestinal symptoms

such as henna, only penetrate a short distance, even after the most thorough oxidation, and the permanency of the coloration is, in the latter case, very much less.

Para-amidophenol is well known, commercially, as rodinal, and the methyl-sulphate salt—metol—is, of course, extensively used in photography as a developer. The amidophenol compounds, as well as the diamines, are very readily oxidizable, even in the air; but, in order to ensure a rapid coloration, the coiffeur mixes with the dye, ten minutes before application, an equal quantity of hydrogen peroxide solution. After thorough shampooing with soap and water, the mixture of peroxide and dye is carefully applied with a brush, and allowed to remain in contact with the grey or faded hair for half an hour, and the scalp is then shampooed once more, any staining of the skin being removed with a little vaseline.

Even in patients whose skin is not especially sensitive, and does not react promptly to rough soaps, alkalies, the contact of wool, etc., and who are not urticarial subjects, the neglect of the second thorough shampoo, or the postponement of this shampoo for an hour after the application of the dye, is often sufficient to set up a subacute dermatitis, accompanied by troublesome pruritus, if nothing more. In predisposed individuals, however, such a neglect of the ordinary methods of precaution is sufficient to start a severe dermatitis, with the usual œdema, vesiculation, and pustulation. With regard to such predisposition, photographers have told me that they are acquainted with individuals in their business who show a special predisposition to toxæmia from such substance as metol, rodinal, and iconogen, and are immune from poisoning from developers such as pyrogallol. Others, again, are very susceptible to pyrogallic poisoning, but not to poisoning from the other developers already mentioned.

I saw, quite recently, an employé of, I believe, the largest picture-postcard printing factory near London, who was suffering from severe dermatitis of the hands and arms. He only handled the post-cards after they had been developed, but the company had been experimenting with a new cheap developer, and he told me that a large proportion of the staff engaged in similar work had developed a similar dermatitis. In this case there seemed to be no question of idiosyncrasy, but of a powerful chemical irritant. Hair dyes of a similar irritating character have, at times, been placed on the market,

is rapidly formed, and the hair quickly coloured. Another dye, called "Koorpa," contains phenylene diamene, both the ortho, meta, and para, but in the form of sulphates, and, therefore, the toxicity of this dye is not great.

But to predisposed individuals, every dye containing paraphenylene diamene is potentially toxic, and should only be used with the greatest circumspection. Not only should the dye not be left on for more than thirty minutes, in any case, before being removed by a thorough shampoo, and any tinted skin cleaned with vaseline, but the greatest care should be taken not to apply the dye to any hair which has been bleached less than three days before with peroxide, since this substance acts as a mordant on the hair, and increases permeability.

Finally, in any individual who has any tendency to eczema, it is wise to paint a little of the skin of the temple, or behind the ear, with some of the dye, and cover it with collodion for twelve hours. If no sign of irritation appears on the painted patch during this period, it is practically safe to dye the hair with the same solution.

I have intentionally limited myself, so as not to tire the reader, to inflammation of the skin, or dermatitis, produced by hair-dyes, and have dealt more particularly with those which are most extensively used. But, if I were to deal with the bad results produced on the hair itself, as distinguished from the skin, I could continue for a long time. I could tell of the drying of the hair which hair-dyes produce, about the way in which they cause it to fall out, and about other bad effects. But, sometimes, some still more unusual, and, even curious, effects are produced. I have already mentioned that a man sued the proprietors of a hair-dye because it turned his hair a magenta colour—and he objected to magenta-coloured hair.

I have seen hair turned green by a hair-dye, and, again, the owner of the hair objected. Pyrogallic dyes will turn some hair a shade between purple and brown, and so on.

But I have said enough to show that those who use hair-dyes take certain risks, and, if they still choose to take those risks, they cannot expect much sympathy from us when unfortunate consequences follow.

such as sickness and diarrhoea in the human subject. Experiments on rabbits show that intra-peritoneal injections of small doses of a weak solution of phenylene diamene, at intervals of ten minutes, are well supported until a dose of 0.1 gm. per kilo of body-weight has been administered. At this stage, some inflammation and irritation of the nasal mucous membrane shows itself, and there is swelling of the lingual papillæ. If, then, an additional 0.02 gm. per kilo body-weight be similarly injected at the same intervals, supra- and sub-lingual œdema becomes so marked that the entry of air is partially blocked and respiration becomes difficult. The rabbit now eagerly drinks any water that is offered to it. If the dose is increased to 0.18 gm. per kilo of body-weight, the respiratory symptoms become more marked, the œdema increases, and the animal dies about an hour after the last injection. If the same dose of a solution of paraphenylene diamene is administered by the stomach, through a cannula, the toxic effects are much more rapidly developed, and the animal develops tonic or clonic contractions almost immediately, and dies within two or three minutes.

When we remember that only about 0.50 gm. of pure paraphenylene diamene, about 0.009 gm. per kilo of body-weight, is necessary to produce the complete coloration of the darkest hair, we see how great a margin of safety exists theoretically.

In contrast with these results, it is found that injections of Bandrowski's base in sterilized water are completely innocuous in the rabbit, but the solution of paraphenylene diamene, oxidized for periods too short to produce this substance, are much more toxic.

The poisonous effects of paraphenylene diamene, as a dye, being so well known—its sale in one foreign country has been prohibited for nearly ten years—efforts have naturally been made to modify it in such a way as to render it less toxic, without impairing its powers of coloration. The solution which has the greatest sale, and is most frequently used by hair-dressers in England, is called "Inecto," but another dye called "Primal," contains sodium sulphite, and toluylen-diamine replaces paraphenylene-diamene, so that a minimum formation of chinondiamene, or none, takes place. Toxic by-products are quickly decomposed, and Bandrowski's base

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I have seen hair turned green by a hair-dye, and, again, the owner of the hair objected. Pyrogallie dyes will turn some hair a shade between purple and brown, and so on.

But I have said enough to show that those who use hair-dyes take certain risks, and, if they still choose to take those risks, they cannot expect much sympathy from us when unfortunate consequences follow.



such as sickness and diarrhoea in the human subject. Experiments on rabbits show that intra-peritoneal injections of small doses of a weak solution of phenylene diamene, at intervals of ten minutes, are well supported until a dose of 0.1 gm. per kilo of body-weight has been administered. At this stage, some inflammation and irritation of the nasal mucous membrane shows itself, and there is swelling of the lingual papillæ. If, then, an additional 0.02 gm. per kilo body-weight be similarly injected at the same intervals, supra- and sub-lingual oedema becomes so marked that the entry of air is partially blocked and respiration becomes difficult. The rabbit now eagerly drinks any water that is offered to it. If the dose is increased to 0.18 gm. per kilo of body-weight, the respiratory symptoms become more marked, the oedema increases, and the animal dies about an hour after the last injection. If the same dose of a solution of paraphenylene diamene is administered by the stomach, through a cannula, the toxic effects are much more rapidly developed, and the animal develops tonic or clonic contractions almost immediately, and dies within two or three minutes.

When we remember that only about 0.50 gm. of pure paraphenylene diamene, about 0.009 gm. per kilo of body-weight, is necessary to produce the complete coloration of the darkest hair, we see how great a margin of safety exists theoretically.

In contrast with these results, it is found that injections of Bandrowski's base in sterilized water are completely innocuous in the rabbit, but the solution of paraphenylene diamene, oxidized for periods too short to produce this substance, are much more toxic.

The poisonous effects of paraphenylene diamene, as a dye, being so well known—its sale in one foreign country has been prohibited for nearly ten years—efforts have naturally been made to modify it in such a way as to render it less toxic, without impairing its powers of coloration. The solution which has the greatest sale, and is most frequently used by hair-dressers in England, is called "Inecto," but another dye called "Primal," contains sodium sulphite, and toluylen-diamine replaces paraphenylene-diamene, so that a minimum formation of chinondiamene, or none, takes place. Toxic by-products are quickly decomposed, and Bandrowski's base

his work is seen in the low mortality of these series, and the fatal cases are, as I am sure he would have wished, described fully.

1.—FIBROMYOMATA AND ALLIED CONDITIONS.

This group of 50 cases falls naturally into three classes:—

- (a) Large interstitial or multiple "fibroids," disfiguring a functionless uterus. This class contains the greater number of cases—32.

Supra-vaginal amputation with conservation of both appendages was the usual operation.

- (b) Single interstitial fibroids removed by enucleation from young or parous women—9 cases.

- (c) The small uniform "fibrotic uterus," with either thick endometrium or an adeno-myoma of the wall. The uterus had previously been curetted in nearly all cases, but recurrence of bleeding led to its removal by the abdominal route.

In this class of nine cases, one died.

On analysis of the group as a whole, the usual features of fibroids are demonstrated. The age incidence was markedly in the fourth decade. The chief symptoms were bleeding, dysmenorrhœa, and pressure effects. One patient had practised self-catheterization for a period of four months, without infecting the bladder. Another had had retention of urine at each menstrual period, for three months. In a third, obstruction to labour was present.

All of the characteristic degenerations of fibroids were met with. In one case of cystic degeneration, it was necessary to defer operation for a month to determine whether a pregnancy was present as well.

Disease of the adnexa was present in the ovaries in 18 cases, in the tubes in three, while in four, evidence of pelvic inflammation was noted.

In the operation of sub-total hysterectomy, the contents of the broad ligament and the uterine vessels were divided between clamps—a rapid and bloodless method.

The convalescence of the 49 successful cases was marred in only one case, where rupture of the abdominal scar occurred after the violent coughing caused by a small

A REPORT ON SIX MONTHS' GYNÆCOLOGICAL OPERATIONS

PERFORMED BY THE LATE RICHARD DRUMMOND MAXWELL, M.D.,
F.R.C.S., AT THE LONDON HOSPITAL.

By A. B. LINDSAY, M.B., B.S., B.Sc.

Surgical Registrar, London Hospital, E.

A FEW days previous to his death, Dr. Maxwell had in preparation an article dealing with his operative work at the London Hospital for the half-year ending December, 1915. To the writer, who had, as Resident Accoucheur, assisted Dr. Maxwell in that period, fell the task of collecting the data of 123 cases.

With the aid of Dr. Sydney Morris, then Junior Resident Accoucheur, this had been completed, and Dr. Maxwell had already grouped the cases as follows:—

1. Fibromyomata and allied conditions.
2. Ovarian tumours.
3. Ectopic gestations.
4. Inflammatory disease of the appendages.
5. Cæsarean section.

These groups did not include, in fact, all the cases operated on for these conditions—some notes not being available—nor did they include operations for malignant disease of the uterus. Dr. Maxwell had indicated the points he wished to emphasize, had frequently discussed the work, and become enthusiastic in his inimitable and expressive way on such a point as the enucleation of fibroids.

But his sudden and untimely end prevented the completion of the paper.

The desire to pay a tribute to his wonderful enthusiasm, and his fascinating personality, has led to the writing of this article, unilluminated by his originality, but speaking truly of his untiring energy, not less so of his skill. He sometimes remarked that he would like to open a discussion on surgical failures. He used quaintly to add, "But the others wouldn't speak." How little ground he had to depreciate

Dermoid tumours	-	-	-	4
Carcinoma of ovary	-	-	-	7
Lutein cyst	-	-	-	1
Fibroma of ovary	-	-	-	1

At operation, six cysts were in a state of torsion, and seven of the tumours had adhesions.

The pathological finding, in one case, M. H., a single woman of 32, was rather at variance with the naked eye appearance at operation, when two large solid ovarian tumours were removed. One lay in the left flank, the other occupied the pelvis. Projecting from the surfaces of both were several tufted papillary growths, about 3 c.m. long. Free fluid was present in the abdomen. Section showed the growths to be adenomatous.

On analysis, the cases were seen to be evenly distributed in the four decades from 20 to 60, and they occurred as freely in parous women as in nulliparæ. In two-thirds, a "lump" was the chief complaint, usually accompanied by pain, especially in the six cases of torsion.

Alterations in the catamenia were not noticeable, irregularity being recorded only in six, whereas, in the remainder the periods were regular, or had been replaced by the amenorrhœa of pregnancy or the menopause.

Diagnosis was often difficult, *e.g.*,

1. A case of encysted hæmorrhagic perimetritis occurring in the puerperium, gave clinical signs of a cystic abdominal tumour reaching as high as the umbilicus. This was diagnosed as a twisted ovarian cyst.
2. An abdominal tumour, the size of an eight months' foetus, was found in a woman married one year with ten months' amenorrhœa. Operation revealed a multilocular adenomatous cyst.

The operation practised was usually the removal of tube and ovary by dividing the ovario-pelvic fold and the broad ligament between clamps. The stumps were approximated and embedded in peritoneum. As a rule, the cyst was not tapped unless the removal intact meant severe damage to the abdominal wall. In one case, in an apparently innocent cyst, tapping was done to save the parietes. A few minims

embolus. Re-suture of a very fat wall resulted in a primary union.

The fatal case belonged to group C

H. K., aged 45, was admitted on 15th October, 1915, with a history of bleeding for six weeks, and was then losing clots. After physical examination, the diagnosis of "small fibrotic uterus" was made. On the evening before operation, she had quite an alarming hæmorrhage, and it was necessary to plug the uterus with adrenalin gauze,—a tent being inserted as well to apply continuous pressure. A sub-total hysterectomy was rapidly performed, but the patient developed bronchitis, and died on the sixth day. Section of the uterus showed uniform fibrosis uteri with very thick endometrium. Both tubes were in a state of hydrosalpinx.

Myomectomy.—It was in the second class that Dr. Maxwell was particularly interested, and it includes cases in which enucleation was practised during pregnancy and in the puerperium. He demonstrated several of these fibroids before the Hunterian Society on February 23, 1916, and the majority of the cases so demonstrated occurred in the period July–December, 1915 (*Clinical Journal*, Vol. XLV., No. 16).

His aim was entirely conservative. So impressed was he by the tragedy of the barren uterus, that he advocated the opening of the cavity, if necessary, to remove adequately an interstitial fibromyoma becoming submucous. In a nulliparous woman of 35, who had been married 18 months, he did so, stitching up the endometrium and the uterine muscles in layers. When, two months later, the patient reported a painless period, he remarked, "What a triumph if she becomes pregnant!"

The operation of myomectomy, unless with a necrobiotic fibroid, entails the loss of much blood, and Dr. Maxwell was always very keen on controlling hæmorrhage, and on preventing any leakage into the abdominal cavity. To this may be attributed, to some extent, the happy lack of troublesome complications and sequelæ.

II.—OVARIAN TUMOURS.

This group consists of 30 cases, with one death. The pathological classification was as follows:—

Uni- or bi-ocular epioophoric cysts	-	-	7
Multilocular pseudomucinous	-	-	-
adenomatous cysts	-	-	-

meeting of the Hunterian Society already referred to.

IV.—INFLAMMATORY CONDITIONS OF THE UTERINE APPENDAGES.

On analysis of the 18 cases in which abdominal, as distinguished from vaginal, operation was practised, the age incidence was found to be decidedly in the 30 to 40 decade. The onset of symptoms occurred from 3 to 15 years after the last—usually the only—child or miscarriage. In a few, some interference with the cavity, such as curetting or the passage of a sound, was the starting point of symptoms.

The average length of history was two to three months of acute illness, following some years of bad health.

Of symptoms, abdominal pain was constant and severe; leucorrhœa, as a rule, was present, but described as slight by some who were, perhaps, not of a cleanly habit; pain or mechanical pressure interfered with the functions of bladder and rectum in two-thirds of the cases.

At the menstrual period, increased loss was the rule, but irregular bleeding, simulating an ectopic gestation, was noted in four.

Physical signs were present on vaginal examination in all cases but one, and they presented themselves by the abdomen as well in one-third of the series.

Diagnosis.—The correct diagnosis was made previous to operation in 13 cases only; in the remainder, exploratory laparotomy was performed. In the single case in which no vaginal signs were present, the patient had, obviously, a general peritonitis, and the case proved to be one of bilateral acute salpingitis. Yellow pus was dripping from the ostia of both tubes, and the peritoneum had failed to form adhesions. With vaginal and abdominal drainage the patient made a rapid recovery.

In the cases in which the diagnosis of diseased appendages was made, the moment of the surgeon's intervention was a matter of choice. Three points were used as guides:—

1. The history.
2. The temperature chart and pulse rate.
3. The condition of the broad ligaments and pelvic floor on examination.

Of these, most reliance was placed on the actual condition of the cellular tissue of the broad ligaments; any

of thick yellowish fluid escaped, and were carefully mopped up, but on section free intracystic papillæ were found.

The fatal case was:—

S. S., aged 28, was delivered of a normal full-time child on the morning of September 22nd, without difficulty. This was followed by abdominal pain and vomiting, which passed off. On September 23rd, at 12 noon, she was admitted with furred tongue, sunken eyes, pale lips, and enormous fluid distension of the abdomen. Laparotomy revealed a ruptured left ovarian pseudomucinous cyst, which was removed. Death resulted ten hours later.

III.—ECTOPIC GESTATIONS.

On analysis of the 15 cases, no noticeable causal factor appears. Macroscopic inflammation was present in only one patient, and a congenital malformation in one. In all, the prominent symptom was abdominal pain, associated, in five, with shock and the signs of severe internal hæmorrhage. The menstrual periods were present in three cases, but the remainder followed the classical description of a missed period, followed by irregular loss. In one a "cast" was identified.

The operation practised was the removal of the damaged tube, the top of the broad ligament being overstitched with catgut. In two cases, in which a tubal mole and hæmatocele were present, it was necessary to sacrifice the ovary. All the patients made uneventful recoveries.

Several students were permitted to examine, under the anæsthetic, the physical signs of a case of tubal abortion. A few seconds later, when the diseased tube was examined, a large branch of the ovarian artery was observed to be freely spurting. It was at once secured.

Two abnormalities of special interest were found. In the first, a left rudimentary horn was discovered, not connecting with the cavity of the uterus. The ectopic gestation was in the left tube, thus demanding "external migration" on the part of either the fertilized ovum or of the spermatozoon.

In the second, the site of the hæmorrhage was, apparently, a double pregnancy in the left tube, rupture having taken place in the ampullary region. Microscopically, no proof of a double pregnancy was demonstrated.

Both of the specimens, together with a full-time ectopic sac, removed in February, 1916, were demonstrated at the

Note on Rupture of old Cæsarean Section Scars.

During this six months of work, Dr. Maxwell had two cases of rupture of an old Cæsarean scar during labour.

In the first, the foetus remained in the cavity, as the rupture was only partial in the upper end of the scar. The symptoms were identical with those of a concealed accidental hæmorrhage. A sub-total hysterectomy was performed with success.

In the second, the foetus escaped into the abdominal cavity, the rupture of the scar being complete. The uterus had contracted down, and an attempt to remove it was unsuccessful, the patient dying on the table.

In neither case—it is fair to state—had the original operation been performed by Dr. Maxwell.

Nature of Suture.—Much of his article, had it been written, would have dealt with this subject. Dr. Maxwell held that catgut was an inefficient ligature, and had finally decided never to use it for suture of the uterus in Cæsarean Section. He used silk in all the later cases. The reasons were:—

1. Catgut is a slightly extensible material, and post-partum contractions may lead to the formation of a layer of blood between the muscle surfaces. This would, later, be converted to fibrous tissue.
2. The involution of the uterus is an autolytic process, brought about by powerful protein-digestive ferments, and the normal rate of absorption of catgut may be accelerated by their presence.

In support of the first point may be cited a case in which, after Cæsarean Section, it was demonstrated that blood had leaked between the cut surface. The uterus was bulky, as a result of many birth struggles, and some difficulty was experienced in approximating the muscle edges.

Experiments to determine the second point are now in course of preparation.

Microscopical section of the edge of the scar in the second case described did not suggest any inflammatory process. The temperature charts in both cases negatived the probability of infection being the causal factor.

I am indebted to Dr. Russell Andrews for access to cases operated on in his wards by Dr. Maxwell, and for his valued criticism and advice in the compilation of this article.

exudation, or any marked immobility of the pelvic floor contra-indicating operation. Free bleeding on vaginal examination was also regarded with suspicion.

When, as in the cases in which exploration was performed, some exudation was found at operation, grave loss of blood and troublesome friability of tissues were encountered.

The pulse-rate was regarded as more important than the temperature. In cases in which this was disregarded, on account of an accompanying low temperature, encysted lymph was generally present in the peritoneal cavity.

Operation.—No fixed operation can be described. Dr. Maxwell was in the habit of separating adherent bowel with finger pressure. He occasionally used a gauze swab. For dividing dense colonic adhesions he preferred scissors, with direct observation.

A favourite route for removal of a diseased tube was to enter the broad ligament just in front of and external to the round ligament. Where possible, ovarian tissue was spared; but in eight cases there was ovarian abscess. When the operation was done deliberately, no drainage was employed. Post-operative shock was noticeable in the cases in which the inflammatory condition had not completely subsided, as evidenced by encysted lymph.

Fatal Cases.—The nature of the adhesions in extensive inflammatory disease of the female pelvic viscera makes the operation for its relief one of the most formidable of abdominal operations. This fact is reflected in the comparatively heavy death rate, 11 per cent.—two cases.

In the first, peritonitis followed an extremely difficult removal of bilateral purulent collections. Multiple fibroids were also present, and were removed. In the second, two large densely adherent tubes were found, one containing pus, the other altered blood. During the separation of the pelvic colon, a rent was made on its anterior wall. This was carefully repaired, but unfortunately prevented the satisfactory administration of salines. The patient died 30 hours later of what was apparently delayed shock.

V.—CÆSAREAN SECTION.

Eight Cæsarean Sections were performed, and live mothers and babies were obtained in all cases.

A CASE OF EXTENSIVE MALIGNANT ULCERATION
TREATED BY X-RAYS.

By FRANCIS HERNAMAN-JOHNSON, M.D., CAPTAIN (TEMPY.), R.A.M.C.

Consulting Radiologist, Aldershot Command, London.

[With Plate III.]

My object in publishing and illustrating this case is not to make much of a remarkable, if temporary, cure. It is to counteract, in some degree, a tendency to the belauding of radium in cancer, as though its action were something apart from and transcending that of all other agents. Numerous photographs have been published, showing the effect of radium in malignant ulceration, and the idea has been cultivated that such results are obtainable in no other way.

Now, the fact is, that there is no experienced worker with X-rays who could not match the photographs of the radium therapist, were he so minded. Indeed, some seven to ten years ago, such photographs *were* published, but they were discontinued, because it was found that, excepting the case of rodents, the good effects were seldom permanent. This was, I think, a mistake, because the results, though temporary, are often of great value to the patient, and the undisputed possession of the field by the radium cases has led to the belief that radium alone could produce such benefits. When the relative accessibility of X-ray and radium treatment is considered, it will be seen that such a persuasion is not to the public interest.

Whether the *permanency* of the radium results is in any way greater, is, at least, doubtful; but, as the following case will show, effects quite as immediately dramatic can be attained by Röntgen treatment.

The patient, a female, aged 36, had had a nævus of the left shoulder since birth, which showed a tendency to enlarge, and to take on a pulsating character. She was induced (about the age of 29) to have it "cut out." The wound never healed, but, on the contrary, gradually burrowed and extended until it finally became the enormous ulcer shown in Figs. 1 and 2, Plate III.

In the meantime, not being recognized as malignant, ointments and lotions had been tried, and the ulcer had several times been curetted. Nothing, however, had given even temporary relief. The patient was finally sent to me, in the hope that X-rays might, at any

rate, ease the pain, which was becoming intolerable. Examination showed prominent glands, both in the axilla and neck, but, as the ulcer was very septic, I thought they might possibly be inflammatory.

The notes date back five years, and the technique employed was not what would be used now. Small doses of unfiltered rays of medium hardness were administered three times a week. At the end of ten days, pain and discharge were less. In four months, complete healing had occurred, as shown in the photograph then taken (Fig. 3, Plate III.).

The patient returned two months later with a small recurrence, not larger than a sixpence. This did not react well to further X-ray treatment. It was curetted and again irradiated. Once more, complete healing took place. In less than six weeks, however, there was a fresh recurrence, following a severe attack of influenza. The patient's general health was much reduced, and from that time the course was steadily downhill, both locally and generally. She died some months later, apparently from exhaustion, but possibly from internal metastasis. The external ulcer at times bled profusely, but never resumed its previous proportions, not more than half the scar breaking down. The patient suffered very little pain from the time of first beginning X-ray treatment to her death. After X-rays were suspended, the raw surface was dressed with a solution of quinine and urea hydrochloride. Aspirin at night secured sleep, and was never needed beyond 15 grs.

There are several points of interest about the case:—

(1) Healing occurred without any irritation or visible reaction; and recurrence came within two months. Modern X-ray technique under like circumstances would aim at producing a definite reaction in a few doses, and then allowing healing to take place without further radiation. Hard, heavily filtered rays are now used. It is interesting to speculate as to whether the "cure" would have stood longer had modern methods been employed.

(2) A patch of malignant ulceration which had become "stale" to X-rays was "resensitized" by curetting.

(3) The serious effects of influenza are illustrated. I have seen many a promising case go to pieces, temporarily or permanently, from a similar cause.

(4) The analgesic effect of X-rays is well shown. The patient was practically free from discomfort for six months of her life. The value of local dressing with quinine and urea hydrochloride and the virtues of aspirin internally also call for notice.

One may ask, Would radium have done better than X-rays in this case? So far as healing the ulcer is concerned, it

PLATE III.



FIG. 1.



FIG. 2.—Patient lying on right side, camera pointing directly into ulcer.



FIG. 3.

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One may ask, Would radium have done better than X-rays in this case? So far as healing the ulcer is concerned, it

could not have done better. Moreover, the extent of the ulcerated surface would have necessitated the use of a very large quantity of radium, unless the applications had been numerous, but these are discountenanced by authorities on radium therapy. It is to men like Finzi that we owe our modern X-ray technique, which is practically as close an imitation as possible of radium technique, so far as number of doses and hardness of rays are concerned. Radium, then, in large quantity, and applied by modern methods, would probably have done as well immediately. The result *might* have been more lasting, but an impartial study of recorded cases hardly lends much support to such a speculation.

Nothing I have said is intended to belittle the value of radium; but the part is not greater than the whole. The gamma-ray of radium is but the end of a therapeutic series, of which the ultra-violet ray may be regarded as the beginning. From the physicist's point of view, ordinary light, X-rays, and gamma-rays differ only in wave-length, and consequently in penetrative power. Clinically, there is some ground for believing that different tumours, etc., require differing wave-lengths to affect them beneficially. In other words, there exists, could we but find it, an "optimum wave-length" for each lesion. Generally speaking, however, "hardness" (shortness of wave-length) seems to make for efficiency in the treatment of cancerous conditions; and until X-rays can be produced, which are approximately as penetrating as the gamma-rays of radium, the latter must be used in selected cases. A further advantage claimed for radium—that it may be surgically buried in the interior of a tumour—will, in my opinion, prove to be more apparent than real. The matter has been discussed at length elsewhere¹; all that can be said here, is that (1) a malignant growth, not being a mathematical sphere, it is not possible to affect it uniformly by any method of tube burial, even if multiple; and (2) the method ignores the part played by the surrounding healthy tissues, and is just as likely to damage them as to stimulate them to beneficial activity.

¹ See Author's opening paper in discussion on "Respective value of Radium and X-rays," B.M.A., Ann. Meet., 1914 (reported in *Archives of Röntgen Ray*, November 1914).

ETHER AND CHLOROFORM ANÆSTHESIA.

BY CAPTAIN R. E. HUMPHRY, R.A.M.C. (T.).

Wharnccliffe War Hospital, Sheffield.

IN these days, when the Great War is pleaded in extenuation of all and sundry shortcomings, I propose to give it as an additional excuse for some plain speaking on the subject of anæsthesia, since such a vast number of anæsthetics, at the present time, have to be administered in consequence of the War. There can be no doubt that the consensus of opinion is overwhelmingly in favour of ether rather than of chloroform, and, seemingly, even Scotland, the home of chloroform, is slowly but gradually coming round to this view. For my own part, I very strongly advocate ether, and consider that the nitrous-oxide-ether sequence should be administered as the anæsthetic of choice in every suitable case. I believe it is the safer anæsthetic, and that it is most probably more obtundent to shock than is chloroform. Now-a-days, open ether is the fashion, and one which, in my opinion, is giving rise to a harmful state of affairs. I admit that *primâ facie* the open method would seem the best mode of administration, and probably it is, but this yet remains to be conclusively proved.

By the open method the patient does not breathe much expired air, and, even to a layman, this would appear very desirable. In practice, however, as long as the calibre of the inhaler employed is a very wide one, and the bag is large and is capable of distension and invagination with a minimum of effort (a jaconet bag is to be preferred for this purpose as it has the additional advantage of allowing a certain amount of interchange of air through the bag wall), I do not think the re-inhalation of partly used air is actually baneful in its consequences, either during the induction period, or subsequently in maintaining anæsthesia, when more fresh air can be allowed. It even has certain advantages, for a little de-oxygenation of the blood reflexly makes the patient breathe more deeply, and, possibly, more uniformly. By the open method, the patient inspires a very cold vapour, whilst the outside of the mask gets coated with frozen moisture from the breath, and becomes, to some extent, clogged. This, to my mind, almost neutralizes

could not have done better. Moreover, the extent of the ulcerated surface would have necessitated the use of a very large quantity of radium, unless the applications had been numerous, but these are discountenanced by authorities on radium therapy. It is to men like Finzi that we owe our modern X-ray technique, which is practically as close an imitation as possible of radium technique, so far as number of doses and hardness of rays are concerned. Radium, then, in large quantity, and applied by modern methods, would probably have done as well immediately. The result *might* have been more lasting, but an impartial study of recorded cases hardly lends much support to such a speculation.

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¹ See Author's opening paper in discussion on "Respective value of Radium and X-rays," B.M.A., Ann. Meet., 1914 (reported in *Archives of Röntgen Ray*, November 1914).

contracted, when the smallest limit of contraction has been ascertained carefully and vigilantly, by now giving a very little more to cause just the slightest degree of dilatation on the top of the smallest limit of contraction, the direct and indirect reflexes to light are just abolished, and the patient is, to all intents and purposes, safe from shock and all other dangers, so long as he is kept uniformly in this stage of anæsthesia. If the anæsthesia is exceptionally long, the persistent and continued lowering of blood-pressure may ultimately be undesirable, but, personally, I do not regard the lowering action of chloroform on the blood-pressure with the apprehension that many do. Often I think that this characteristic has a conservative and resting effect on the heart, at a time when the undue strain, from the illness necessitating the operation, has previously affected it by toxæmia, shock, or both, and that, later, this resting effect may even help the heart to cope with the reflex effect on its action of post-operative shock.

With ether, the greatest virtue is safety, especially in the induction period. Subsequently, if the anæsthesia has to be a protracted one, it is often advisable to go on to chloroform to avoid the continued use of a vapour still more irritating than chloroform to the respiratory mucosa. With ether, too, one cannot gauge with quite such precision as with chloroform the stage at which we believe anæsthesia to be just complete. Statistics on the relative safety of the two anæsthetics are, in my opinion, very erroneous and misleading. Deaths under chloroform usually occur in the induction period, before the third stage of anæsthesia is reached, when, in certain cases, it is comparatively easy for the patient to get a sudden overdose. They often occur in subjects predisposed to shock, when the operation is commenced during incomplete anæsthesia, and sometimes a sudden fatality may take place, even at the end of an operation, when the last skin sutures are being inserted. In some of these cases so predisposed to shock, such a catastrophe is not uncommon, if complete anæsthesia has not been uniformly maintained until the last skin suture has been inserted. In any case, with chloroform, if a tragedy does occur, it is nearly always on the actual operating table, and it is partly, or entirely, due to the chloroform.

It may be, in very small measure, directly due to it, but it is inextricably associated with it, and an inquest is

the achievement of breathing always more or less fresh air. Further, by the open method, it is not possible to gauge, even approximately, the strength of the ether-vapour, which can be done automatically, and altered as often as necessary, by the other method.

Extravagance of ether is a point, too, that must be taken into consideration. No anæsthetist knows just how much ether-vapour his patient is inhaling, or how much is simply evaporating into waste, and few realize the very large quantity that is actually required to keep the average subject in a state of complete, though light, anæsthesia. Since incomplete anæsthesia is one of the greatest dangers in the administration of every anæsthetic, it is not much use employing one which is rather more obtundent to shock, when, very often, complete anæsthesia is not attained, or is not uniformly maintained, and the patient is thus not immune from shock during the administration, the effects of which will be felt subsequently. As so much ether is required, occasionally a doctor may have insufficient with him, and, invariably I find that he has a bottle of chloroform at hand. Not only is this so, but frequent recourse is made to the chloroform bottle. I do not suggest that this is very wrong, for, under most circumstances, it is safe, but in certain uncommon cases it may possibly be the cause of a tragedy.

A practice which, I believe, is a very common one, and which, I think, ought to be condemned, is the following. The induction-stage of anæsthesia by the open method being a great deal more difficult than that by the nitrous-oxide-ether sequence, I believe that a very large number of practitioners get over the difficulty by inducing anæsthesia with chloroform, and then go on by giving ether on the mask by the open method, with a piece of gamgee wool, to help to exclude the air between the mask and the face. Occasionally, too, chloroform is dropped again on this same mask, which is not overwise, but, while not wishing to be taken too literally, I consider that the practice successfully combines the disadvantages of both chloroform and ether, with the advantages of neither.

With chloroform, the chief dangers are encountered in the induction-period, that is, in the first and second stages of chloroform anæsthesia. After this, in the third stage, when the eyes look straight forward and the pupils are well

contracted, when the smallest limit of contraction has been ascertained carefully and vigilantly, by now giving a very little more to cause just the slightest degree of dilatation on the top of the smallest limit of contraction, the direct and indirect reflexes to light are just abolished, and the patient is, to all intents and purposes, safe from shock and all other dangers, so long as he is kept uniformly in this stage of anæsthesia. If the anæsthesia is exceptionally long, the persistent and continued lowering of blood-pressure may ultimately be undesirable, but, personally, I do not regard the lowering action of chloroform on the blood-pressure with the apprehension that many do. Often I think that this characteristic has a conservative and resting effect on the heart, at a time when the undue strain, from the illness necessitating the operation, has previously affected it by toxæmia, shock, or both, and that, later, this resting effect may even help the heart to cope with the reflex effect on its action of post-operative shock.

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It may be, in very small measure, directly due to it, but it is inextricably associated with it, and an inquest is

invariably held, which accentuates the association. Further, I feel sure there are more men of small experience who employ chloroform than there are men of small experience who employ ether.

I consider that deaths, as a direct and indirect result of ether, are quite common, though it is certain that nearly all of them escape the coroner's court, because they do not, like chloroform, actually take place in the operating theatre. With chloroform, serious troubles are usually in the theatre, and not in the wards, but with ether it is just the converse. If ether is given to a person whose condition is so serious that the pulse (from toxæmia, febrile disturbance, etc.) is very small, weak, ill-sustained, and very slightly irregular before the operation, this patient will most probably come through on the actual operating table, but he will almost inevitably succumb in from half-an-hour to an hour and a half following it. The tired and worn-out heart will most probably respond sufficiently to the stimulating ether for the time, but the re-action subsequently will be in a more or less equal and opposite direction.

Now the heart, which had difficulties before, will become, as a result of whipping up its action, still more irregular, and flicker out altogether. This state of affairs might probably be avoided by giving chloroform, and, afterwards, judiciously stimulating and protecting the heart.

Indirectly, ether is often the cause of losing lives by the ether-bronchitis and ether-pneumonia, which it sets up; yet not one of these cases comes into a coroner's court, and I wonder how many of them are called ether-fatalities.

Statistics show the percentage mortality to be much higher with chloroform than with ether, and most coroners are cognizant of this, hence, it usually happens that the first question he asks is "What was the anæsthetic given?" If it is chloroform, the cross-examination of the unfortunate anæsthetist is commenced under rather unfavourable circumstances, for it must be, at least, extremely difficult for a lay-coroner not to be biassed against the administration of chloroform in almost all circumstances, when its percentage mortality is apparently a good deal higher than that of ether; moreover, it cannot be an easy matter to convince him, if his knowledge of medical matters is not a very large one, and he is prebiassed in favour of ether by so-called facts and figures.

Chloroform is the better anæsthetic of the two for infants, and for women during labour. It is usually better as well for elderly people, particularly if any undue irritability of the lungs, or advancing renal or arterial degeneration is present. In septicæmic cases, it should be given in preference to ether.

I think it is safe to begin an anæsthesia with ether, and when the patient is very nearly under, to give chloroform, but I do not think the much more common practice of starting with chloroform and suddenly giving a douche of ether on the mask during incomplete anæsthesia is free from danger. In most instances, nothing much happens; but there are two classes of case, in which very alarming symptoms may immediately supervene, and often terminate in more or less sudden death. These two classes are lymphatism and disease of the auriculo-ventricular bundles of His. I understand, from others who know more about the latter condition than I do, that even the comparatively trivial excitation set up may be sufficient to cause ventricular fibrillation and sudden death. In lymphatism, at certain times, if chloroform is being administered, and the patient is suddenly switched on to ether during incomplete anæsthesia, I am sure that this might be the exciting cause of very serious trouble, perhaps ending fatally on the operating table. In lymphatism, I do not know if ventricular fibrillation is the cause of the very sudden fatalities, but I think it may be possible in some cases, for there is usually present a well-marked fatty degeneration of the myocardium of the heart, and I expect there are, probably, degenerative changes in the nerves as well. I am sure that ventricular fibrillation does not account for many of the rather sudden fatalities in lymphatism, for I have seen several cases where, as a result of shock, the respiratory symptoms suddenly became alarming some appreciable interval before the heart was affected, at a time when no anæsthetic was being, or had been, given. Personally, I like to give, as a routine, gr. $\frac{1}{100}$ th, atropine sulphate, with or without morphia sulphate gr. $\frac{1}{8}$ th to gr. $\frac{1}{4}$ th, hypodermically one hour before the administration of ether, and often to employ, hypodermically, scopolamine or hyoscine hydrobromide gr. $\frac{1}{50}$ th or $\frac{1}{20}$ th, either by itself or with $\frac{1}{8}$ th to $\frac{1}{4}$ th of a grain of morphia an hour before the administration of chloroform. I think the latter plan better than ether, etc., for soldiers suffering from "shell-shock."

Practical Notes.

HYPOCHLORITE OF MAGNESIA AS AN ANTISEPTIC.

Charles Meyer recommends the use of an antiseptic, which closely resembles hypochlorite of soda in composition, and has the advantage of not being caustic, and so not needing to be neutralized. Excellent results have been obtained from its use. The solution is easily prepared by mixing 190 grammes of magnesia sulphate, dissolved in 2 litres of water, and 100 g. of chloride of lime dissolved in 2 litres of water. The sulphate of lime, formed as a precipitate, is allowed to settle, and the solution is filtered. The hypochlorite of magnesia has rather less antiseptic power than chloride of lime. About 7 to 9 per cent. more must be added to render test-cultures inactive. It is, however, perfectly tolerated by the tissues, so that large quantities can be used without any fear of irritating the wound. Healing takes place quite as quickly in wounds for which it has been used. There is no need to add boric acid for neutralizing the alkalinity, an excess of free magnesia is rather to be sought for than avoided. The organism can support the presence of magnesia very well, which is not the case with free soda or lime.

The use of hypochlorite of magnesia, in solution, is recommended for use as an antiseptic, because of its good antiseptic properties, its freedom from causticity, and its low cost and easy preparation.—(*Journ. de Méd. et de Chir. prat.*, 10 March, 1916.)

A SUGAR-DIET IN GASTRIC ULCER.

Lœper recommends the use of sugar in cases of "intolerant" ulcer of the stomach. The term is applied to that form of gastric ulcer, which gives rise to such frequent vomiting that nothing can be retained in the stomach. Bleeding occurs in these cases, as in others, but not so frequently nor to any great extent. Nausea is common, and pain is felt, sometimes soon and sometimes later, after taking food. It often is so intense and spread out so widely that taking food becomes extremely difficult and even impossible.

Milk is not tolerated well by many of these cases. It ferments easily in the stomach, producing lactic acid and gas, the fat promotes gastric stasis, and the casein coagulates coarsely. The lactic fermentation can be prevented by the use of alkalines and lime. Skimming off the cream removes the greater part of the fat, and makes the milk more digestible. The large size of the clots can be prevented by making the milk homogeneous, by diluting it, and by adding substances like chloride of calcium and rennet, which bring about fine coagulation of the albuminous mass. Mathieu recommends the use of dilute citrated milk. One litre of this is composed of two-thirds three-quarters, or four-fifths of milk with water added to make the quantity, in which are dissolved 10 g. of citrate of soda. The amo

of milk in the mixture is increased gradually according to the tolerance shown by the patient. Small quantities, gradually increasing in amount, are given frequently.

In most cases this method is very effectual, and gives rise to no pain. The citrate of soda not only allays the gastric intolerance, but has as well a strong alkaline action, and very seldom causes milky urine like bicarbonate of soda. It is possible for a patient to take from 1200 to 1500 c.c. of citrated milk, an amount which will keep the weight level, if it does not increase it.

There are, however, some patients who cannot take citrated milk. In some, it causes more or less acute pain, and in others, sour and acrid eructations occur; others are constipated as with plain milk, whilst others continue to lose weight. Under such conditions, some other method of feeding must be adopted. Among these the sugar diet is of particular interest. Sugar is a food of the first rank, but has seldom been used in the *régime* for gastric ulcer. Lœper, for some time past, has tried sugar in patients of this sort, and having obtained good results, has drawn up the following plan. First of all he includes syrups flavoured in every possible way—gooseberry, pomegranate, cherry, raspberry; clear jellies of preserves, slightly acid and without pips, apples, gooseberries, quinces; barley-sugar and sweetmeats of gum; *sorbets* of all kinds provided they contain no alcohol; *tisanes* of apple; lemonade, orangeade, and fresh grape-juice.

As a rule, this diet is well tolerated by the patients and does not set up gastric pains, if the sugar is always sufficiently diluted. It gives rise, however, to some fermentation, but, in consequence of its quick absorption, much quicker than in the case of farinas, as well as its easy assimilation in the intestine, the fermentation is of little account and is rarely troublesome. The lack of mineral substances may be redressed by adding phosphate of soda and phosphate and carbonate of lime to the diet in small quantities.

The diet should not be given for longer than five or six days. It is in no way complete, but represents an urgency ration, the rapid absorption of which supplies necessary or satisfying nutriment for the moment. As soon as the stomach permits, the sugar is gradually replaced in the dietary by light food, soups, bouillon, arrowroot, tapioca, then by purées of potatoes, lentils, and haricots, and with well-baked biscuits. By slow degrees, the stomach is accustomed to a fuller diet, until a normal dietary can be taken and properly digested.—(*Journ. de Méd. et de Chir. prat.*, June 10, 1916.)



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faithful guardianship to bring about the ideal goal we are striving for," but we are convinced that in appealing to the ethical aspect of human nature alone nothing but failure will result, it is only by the help of definite religious training that men can be brought to live pure and unselfish lives. In spite of this omission, these two papers deserve careful consideration. The paper on "Defects in our Public Insane Hospital Systems" is in favour of these institutions being officered like general hospitals, *i.e.*, with resident medical officers, with visiting physicians. In the "Malingering," a clinical study, Dr. Gluck discusses at length the psychology of malingering, and gives a full report of some interesting cases.

To the War we are indebted for the paper by M. Rahm, of Zurich, viz., "War Experiences and Observations in Germany and France."

This volume, like the two previous volumes, is most profusely illustrated with plates, figures, diagrams and charts.

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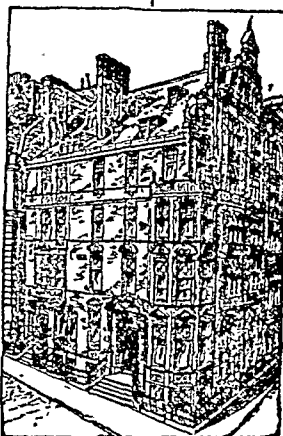
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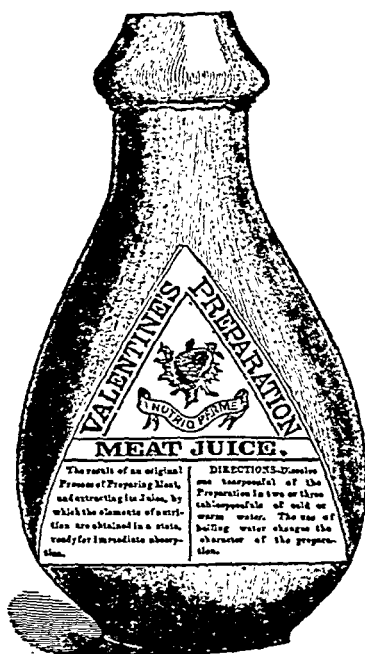
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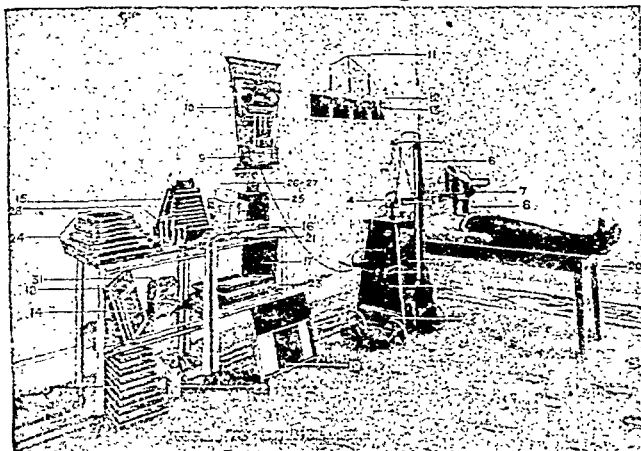
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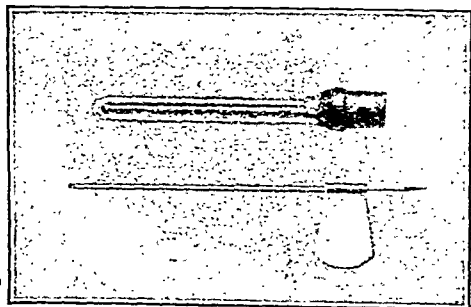
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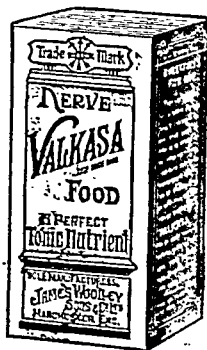
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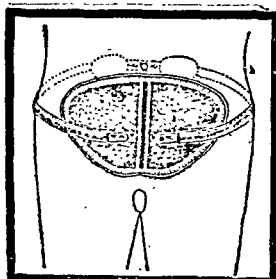
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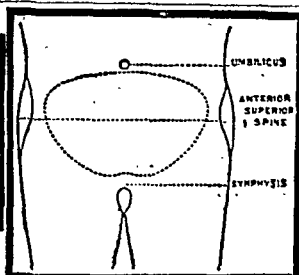
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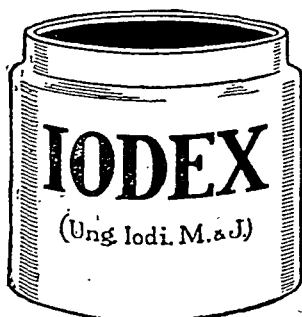
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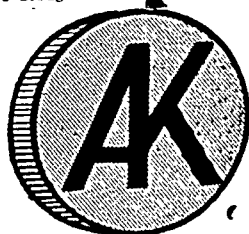
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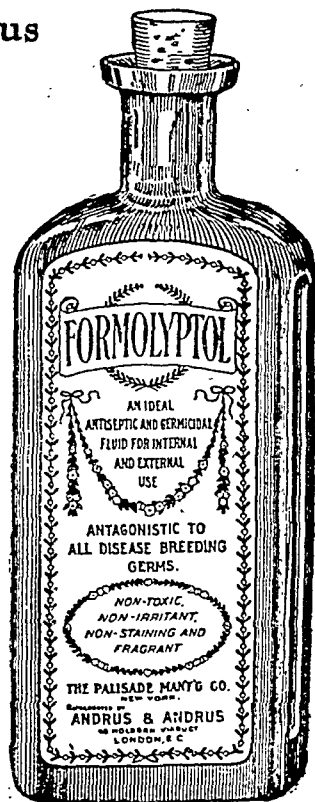
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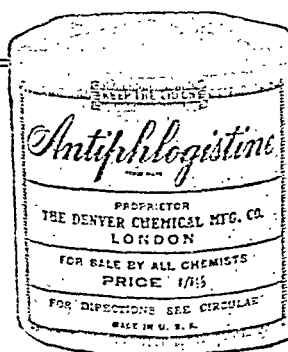
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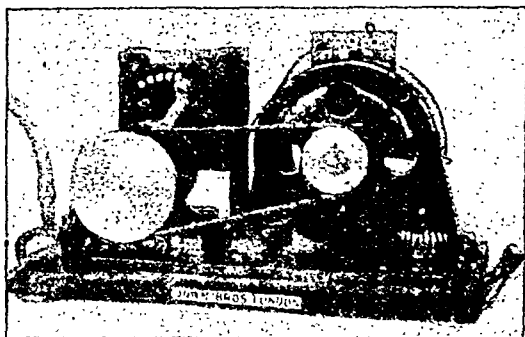
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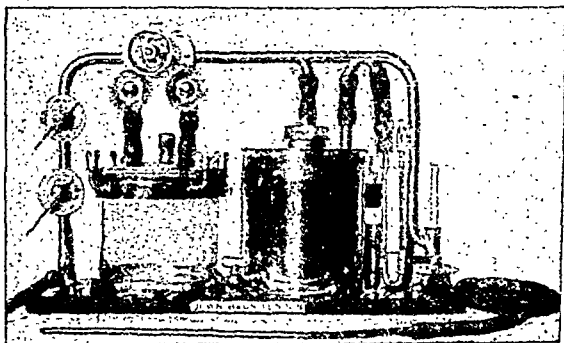
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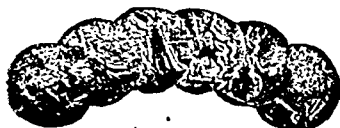
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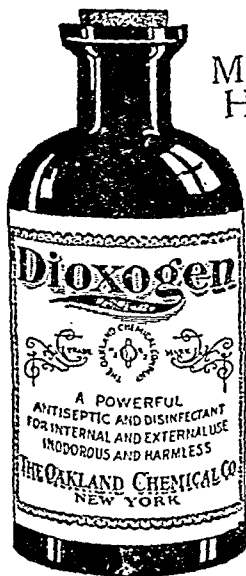
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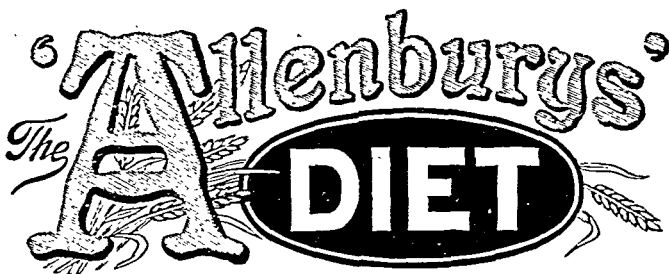
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Obtainable through all Chemists or direct from the
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Assyrian King in his chariot, hunting lions. The figures in adoration before the Tree of Life, surmounted by the symbol of Asshur, here reproduced, are embroidered on the Monarch's pectoral. Date, circa 669-626 B.C.

THE PRACTITIONER.

JANUARY, 1916.

TREATMENT OF CEREBRO-SPINAL MENINGITIS.*

(a) BY SIR WILLIAM OSLER, BART., M.D., F.R.S.

Regius Professor of Medicine, Oxford University, etc.

FOR the first time in the medical history of these islands, cerebro-spinal fever has prevailed as an epidemic, with the usual characteristics, *i.e.*, a low case-incidence, a widespread yet capricious distribution and predilection for soldiers, particularly young soldiers, a high case-mortality, and a rapid disappearance of the disease with the approach of fine weather. The figures of its distribution and prevalence are not yet available. As usual in Europe, the military population has suffered most. In the first year of the war there were, in the home Army, 462 deaths, which places the disease second on the list of causes of death from acute infections—probably a very much larger proportion than among the civil population. When the returns are made, it will be seen that the deaths from cerebro-spinal fever form but a small proportion of the total deaths from meningitis. I hope that one result of the careful studies recently conducted will be a more accurate registration of the forms of the disease.

For the year 1913, the Registrar-General reported 9,269 deaths from meningitis in England and Wales. More than half, *i.e.*, 5,018, were the tuberculous form. Of the balance, 159 were classified as posterior basic, 163 as cerebro-spinal fever, and 3,819 as "other forms." More information is needed concerning this last group, in which a not inconsiderable number may be due to the meningococcus. Cerebro-spinal fever is not only interesting as an epidemic, but as a meningitis it has the fortunate distinction of being the only variety from which recovery takes place in from 50 to 70 per cent. of the cases. Many men of large clinical experience have never seen recovery in the tuberculous, pneumococcic,

* This symposium is based upon a recent discussion at the Royal Society of Medicine; each paper has been specially revised and amplified by the author for this number of THE PRACTITIONER.

AMBULATORY TREATMENT OF FRACTURE OF THE LIMBS, TUBERCULOUS AND ARTHRITIC DISEASE OF JOINTS.

By C. A. HOEFFTCKE, 21, Woodstock Street, Oxford Street, London, W.

HOEFFTCKE'S UNIVERSAL LEG SPLINT.

Patent App. No. 13976/15.

It is now nearly four months since I first introduced this splint, which is designed on similar lines to my Ambulatory Extension Splint, only in cheaper form. In the opinion of surgeons who have tried it, it is the best splint ever produced, and the results obtained, even in that short time, have been most satisfactory.

It is designed to meet the urgent demand for an inexpensive splint of an ambulatory nature of simple design adjustable so that it can be applied to any case of injury to the lower limbs and ready for immediate use, as for the wounded on the field, rendering a man so fitted to be able to bear extension up to 10 or 15 lbs. without producing further complications or excessive pain, while the wounds are easily accessible.

For fractures with large wounds through shot or shell the splint can be used in the beginning when in the recumbent position until such time that the wounds are so far recovered that there is no fear of further hæmorrhage or other complications. When the leg can be brought in the perpendicular position, without any danger to the wounds, the same splint can be used for walking purposes while the bones are uniting, as is the case with my Ambulatory Extension Splint, as the extension arrangement keeps the fractured ends of the bones in good position.

The advantages over other splints can be summed up as follows:—

The top part of the splint presses solely against the gluteal muscles and tuber ischii.

The perineum and pubic bone are entirely free from pressure, so that the irritation and pain which the ring of Thomas's and similar splints produce are entirely done away with.

As soon as the splint is put on and extension applied the grating between the fractured ends and consequent twitching of the muscles ceases.

The patient is enabled to sit upright and not confined to the recumbent position, as in a long Liston.

The upper part of the appliance being composed of two divisions, an inner and outer part, can be adjusted so that it fits the thigh like a glove, so that it does not stand open at certain places like a Thomas's, or Wallace Maybury, or similar splints.

The greatest advantage, however, is, in a fracture which is not compound—that the patient is enabled to walk without crutches while the fractured ends are held in good position, almost immediately after the splint is applied, in some cases three days after the accident.

The Universal Splint can also be used with great success for tubercular knee and ankle-joints. For a tubercular hip, and also for a fracture above the lower third of the femur, a pelvic band has to be added to the splint. The great advantage in using this splint for tubercular joints is that no crutches are needed, and that the clumsy elevation (patten) under the other boot which is used with Thomas's splint is not needed. An ordinary boot can be worn over the foot part of the appliance.

This splint is especially designed for the poorer classes, and for war cases. If the patient can afford it, Hoefftcke's Extension appliance, which is made of leather and steel, and is jointed at ankle, knee, and hip, and described by many surgeons in their books, and in medical journals, is more advisable.



Back view showing the separation of the two halves of the upper part of the thigh-bucket which can be adjusted to any size of thigh.



Back view of splint showing impact of the tuber ischii with soft tissues on top of the splint.

factor. Fatigue lowers resistance, wet and cold and the excessive use of tobacco favour pharyngeal catarrh ; too often the huts and tents are overcrowded, nights are cold, blankets thin ; what wonder that the men close the windows, and lace up the tents tightly, so that the air becomes foul. The carrier does the rest, distributing the germ to a young fellow whose resistance is weakened, or whose naso-pharynx forms a suitable medium.

During next winter, medical officers in charge of camps and barracks and of men quartered in houses should do three things :

- (1) Guard the young soldier especially against over-fatigue. I know that is a very easy thing for me to say, and a very hard thing for the medical officer to ensure.
- (2) Reduce to a minimum the circumstances favouring naso-pharyngeal catarrh.
- (3) Make possible a combination of good ventilation of sleeping quarters with comfortable warmth for the men.

You can get comfortable warmth and good ventilation combined, but you cannot secure comfortable warmth in many of the conditions in which the men are. I saw once six men in a room in which I would not put three ; they were quartered in villas. The windows were shut, and the door was shut until I opened it ; the men were sleeping on mattresses on the floor. One of them said, " We have got to shut the window to keep ourselves warm." I think the public health authorities and the medical officers in charge of camps should bear these points in mind, with reference to the possibility of a recurrence of the disease this winter.

The prophylactic use of anti-meningitic serum is still on trial ; we do not know enough to recommend it or to discourage it. I hope this discussion will elicit the results which have been achieved by those who have employed it. On present knowledge, specific therapy combined with lumbar puncture is the rational treatment, combating the sepsis by means of the one and the pressure effects of the local exudates by the other means. We are agreed as to the value of withdrawal of fluid from the spinal meninges. On the value of specific therapy, however, there is a grave difference of opinion. The use of the serum is based on sound experimental data.

or streptococcal varieties. I have not myself had a recovery in cases under my care of any of those three forms. I have seen one case of doubtful tuberculous meningitis recover; and I saw, last autumn, at the Cleveland Hospital, one case of streptococcal meningitis recover. It was determined to be streptococcal by that streptococcus specialist, Dr. M. H. Gordon. The meningococcus is always present. It may be grown in pure culture; it has specific serological reactions, and the disease may be reproduced in animals. It has "strains," which, however, have not yet been worked out satisfactorily, neither has their existence yet been sufficiently considered, seeing that they present differences in agglutination, opsonization, and complement fixation. I hope that matter will be cleared up in the present investigation.

Two points call urgently for discussion: the prophylactic measures, and the serum treatment. The others, in comparison, are subsidiary and unimportant.

We may, I think, expect a return of the disease this winter. There are instances of a progressive yearly increase in the virulence of the epidemic. What preparations should be made in the prospect of such a renewal? Let us recognize a certain value in the conception of the disease propounded originally by Dopter, and supported in this country, among others, by Arkwright, Lundie, Thomas, Fleming, and MacLagan. These men hold that the epidemic is in the carrier; the meningitis is regarded by them as an incident. The germ is ubiquitous, and is harboured by many who show no symptoms of the disease, but producing in others a mild catarrh, and only in a few reaching the meninges. This is what happened in the case of pneumonia, in which the proportion of cases to carriers is even smaller than in the case of cerebro-spinal fever. The germs may be present in the throat without the occurrence of naso-pharyngeal catarrh; it may be present in a severe case of the disease, without any indication other than that obtained by cultures.

Two broad facts stand out:

- (1) The correlation of the seasonal prevalence with naso-pharyngeal catarrh, and
- (2) The influence of overcrowding in ill-ventilated barracks and houses.

The concentration of human beings, particularly of young recruits in camps, seems to me to be the most important single

factor. Fatigue lowers resistance, wet and cold and the excessive use of tobacco favour pharyngeal catarrh ; too often the huts and tents are overcrowded, nights are cold, blankets thin ; what wonder that the men close the windows, and lace up the tents tightly, so that the air becomes foul. The carrier does the rest, distributing the germ to a young fellow whose resistance is weakened, or whose naso-pharynx forms a suitable medium.

During next winter, medical officers in charge of camps and barracks and of men quartered in houses should do three things :

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The long study of Flexner and his pupils and others have made possible the production of a serum which has a specific influence on the meningococci in the spinal canal, partly by a direct bacteriacidal action, partly by bringing about phagocytosis; and there may be an antitoxic action. No one can have followed the work at the Rockefeller Institute on the meningitis problem, without having been impressed with the fact that it is solid, sound, good work, and that, if there is any truth in the serum therapy, it is just on such researches that it must be based. The specific treatment has been in use for some years, and details of the results are readily to be found, particularly in the recent monograph of Sophian; the last table in his book gives the collected statistics of cases treated with, and without, the serum, and, if they are worth anything, the figures show an overwhelmingly strong case for specific therapy.

The practical points for us to discuss are, first, the experience of the past few months; and, secondly, its lessons for the future. We must be disappointed in many quarters with the serum treatment. The reasons for the failure should be laid open freely and frankly; what we wish is to get a statement of the truth of the matter. The consultant only sees severe cases, and cases which are far advanced. It has been said that when the cases reach us, they are in a condition to receive "extreme unction." The death-rate has been high, and I hope the figures for the whole country will be available.

I was much interested in the outbreak among Canadian soldiers at Salisbury, where 40 cases were treated, with 26 deaths—a mortality of 63 per cent. The sera used were from Burroughs Wellcome, Lister Institute, Mulford, and Parke, Davis. It was said that a few of the patients treated with Mulford's serum suggested that some improvement had taken place, but it was hardly striking enough to justify its use. There was no benefit from the other sera. In one case, the meningococcus was isolated two and a half months after the illness, and after more than 20 intraspinal injections had been given. In another case, meningococci were found in the fluid five weeks after the onset of the illness, during which there were 12 injections. This is the figure from one who is an expert in the technique of intraspinal treatment. I have seen it given by the gravity method, and with great skill. There were no better results at Haslar. There were 30 cases there, with a mortality of 52 per cent., and the use of the serum

was abandoned after eight deaths in 12 cases. Happily, the man with the largest experience, Dr. Gardner Robb, of Belfast, tells a different tale.

We want to know the reasons for this widespread failure. I think there has been one main cause: inert sera. We do not know in how many cases the parameningococcus was present. That does not react to the ordinary antimenigitic serum. There have been as well insufficient dosage, failure to treat cases early, and imperfect technique; these have been minor contributory causes. There are, of course, cases which resist all treatment. We cannot expect, by any form of treatment of cerebro-spinal meningitis, to get a mortality below 20 to 25 per cent.; we have to deal with acute, malignant, fulminating cases, which die in 24 to 36 hours; and there are some deaths from complications. But we have to face the problem, that there is this extraordinary discrepancy between the results obtained in many quarters in this country and the results obtained by Flexner and others, in recent epidemics in the United States and elsewhere. It may be a question, as I suggest, of inert sera. I think this should be made a War Office problem, and be placed by them into the hands of experts who shall investigate sera, so that we can be certain that they correspond to the strain of organisms present in the prevailing epidemic.

(b) BY A. GARDNER ROBB, M.B., D.P.H.

Medical Superintendent, City Fever Hospital, Belfast.

I HAVE always been greatly interested in this subject, for in Belfast and the North of Ireland we have suffered severely from outbreaks of this disease since 1907.

Before the introduction of the serum of Flexner, there occurred in Belfast a severe outbreak. In the first seven months of that outbreak, I had under my care in the Fever Hospitals 275 cases, and the death-rate was over 72 per cent. Then I received from Dr. Flexner a supply of the serum, on the preparation of which he had been working for a long time. It had already been tried in a few scattered cases in America with good results. I began its use in the beginning of September, 1907. The change in results was dramatic. The death-rate fell at once to one-third of what it had been. The death-rate in our hospital cases had been over 80 per cent. in

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The practical points for us to discuss are, first, the experience of the past few months; and, secondly, its lessons for the future. We must be disappointed in many quarters with the serum treatment. The reasons for the failure should be laid open freely and frankly; what we wish is to get a statement of the truth of the matter. The consultant only sees severe cases, and cases which are far advanced. It has been said that when the cases reach us, they are in a condition to receive "extreme unction." The death-rate has been high, and I hope the figures for the whole country will be available.

I was much interested in the outbreak among Canadian soldiers at Salisbury, where 40 cases were treated, with 26 deaths—a mortality of 63 per cent. The sera used were from Burroughs Wellcome, Lister Institute, Mulford, and Parke, Davis. It was said that a few of the patients treated with Mulford's serum suggested that some improvement had taken place, but it was hardly striking enough to justify its use. There was no benefit from the other sera. In one case, the meningococcus was isolated two and a half months after the illness, and after more than 20 intraspinal injections had been given. In another case, meningococci were found in the fluid five weeks after the onset of the illness, during which there were 12 injections. This is the figure from one who is an expert in the technique of intraspinal treatment. I have seen it given by the gravity method, and with great skill. There were no better results at Haslar. There were 30 cases there, with a mortality of 52 per cent., and the use of the serum.

was abandoned after eight deaths in 12 cases. Happily, the man with the largest experience, Dr. Gardner Robb, of Belfast, tells a different tale.

We want to know the reasons for this widespread failure. I think there has been one main cause: inert sera. We do not know in how many cases the parameningococcus was present. That does not react to the ordinary antimeningitic serum. There have been as well insufficient dosage, failure to treat cases early, and imperfect technique; these have been minor contributory causes. There are, of course, cases which resist all treatment. We cannot expect, by any form of treatment of cerebro-spinal meningitis, to get a mortality below 20 to 25 per cent.; we have to deal with acute, malignant, fulminating cases, which die in 24 to 36 hours; and there are some deaths from complications. But we have to face the problem, that there is this extraordinary discrepancy between the results obtained in many quarters in this country and the results obtained by Flexner and others, in recent epidemics in the United States and elsewhere. It may be a question, as I suggest, of inert sera. I think this should be made a War Office problem, and be placed by them into the hands of experts who shall investigate sera, so that we can be certain that they correspond to the strain of organisms present in the prevailing epidemic.

(b) By A. GARDNER ROBB, M.B., D.P.H.

Medical Superintendent, City Fever Hospital, Belfast.

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No one who has had any considerable experience in the treatment of this disease without intra-spinal injections of serum, and has then had an opportunity of observing the results of such injections, can have any doubt as to the enormous value of this treatment; and I believe I am correct in stating that *every one* who has had such opportunities is enthusiastic regarding the success of this method of treatment. To this I think there is not any exception, as shown by the writings of Dunn, Emmett Holt, Ladd, Royer, Sophian, Fulton, and many others in America; of Netter and Dopter in France; of Claude Ker of Edinburgh, and of Christomanos, with his large experience, in Greece. The same unanimity is to be found in the records from Germany, where similar success was obtained after the adoption of the intra-spinal route for the administration of the antiserum.

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getting even better results, for, owing to the experience we had had, the diagnosis was more likely to be made quickly and, the value of early injection of serum being fully recognized, the cases would most probably be sent into hospital without delay. It was apparent, too, that we should have many cases from the camps, and these would generally be in good physical condition, and at a time of life when good results were to be expected. But, unfortunately, the results, instead of being better, have not been so good. Since the beginning of last winter I have had 92 cases in hospital, and have treated 8 cases in various places outside, making exactly 100 cases. Of these, 36 have died, a case-mortality of 36 per cent. In the total number we had previously, the death-rate had been 24 per cent.

In trying to find an explanation of the cause of this increase several questions occur to one:—

- (1) Was the disease of a more virulent type?
- (2) Was there any marked difference in the average age of the patients, which might make for a higher mortality?
- (3) Can the increase be accounted for by differences in the strains of the meningococcus?
- (4) Was the serum available of as high standard of immunity value?

(1) Regarding the virulence of the type, it is very difficult to make a correct estimate, but my opinion is that the recent outbreak was not more severe in type than formerly; although, so far as I have been able to ascertain, no case occurring in the North of Ireland during the past winter and spring, which was treated without serum, recovered. There were several. Unfortunately, the disease is not notifiable in all our sanitary districts, so that it is not possible to obtain exact figures.

(2) The average age of the patients has been higher in the recent outbreak. This should, on the results generally reported in former outbreaks, make rather for a lower case-mortality, but my own experience has been that young children give very good results when treated with serum, provided they come under treatment reasonably early. It is in the infants that the greatest improvement in results has been obtained, since the serum treatment became general. In

children under one year treated without serum, a death-rate of 90 per cent. had been common. With the serum they do quite as well as cases in other age periods. In the present outbreak, I have had 17 cases in children under five years with only four deaths—less than 25 per cent. One of these fatal cases had already been over 50 days ill, when admitted from a country district 25 miles from the city.

(3) Is the increase in the mortality to be accounted for by differences in the strain—strains not provided for in the polyvalent serum available? In the discussion here last February, I believe that the general impression held by many of those taking part was that the resistance to the serum treatment, shown by many of the cases then occurring, was thus to be accounted for. During the early spring, I had several cases which were received into hospital quite early in the attack, but, though living long enough to receive several daily injections, they showed only very temporary improvement or none at all, and ended fatally. I am aware that cases of this kind have been met with amongst the serum-treated cases elsewhere; personally, I had not met with such cases in my former experience in the use of the serum. My experience had been that, if a case lived for ten days or a fortnight, it recovered. In this outbreak that did not hold good I may instance one case which occurred amongst my recent cases. A robust soldier of 20 years was admitted with a severe attack on the first day of illness; he received repeated injections, showed some improvement at first but only for a short time. In all, he was given 15 injections—480 c.c. of serum—and had over 1,100 c.c. of fluid drained off from the canal. He went steadily downhill, and died after four weeks. The meningococcus was present in the cerebro-spinal fluid till the end. In my former series, I had not met with such cases. Having had some correspondence with Dr. Flexner on these resisting cases, I collected specimen cultures of the organism from cases in various places, and took them over to New York for comparison with the strains being used in the preparation of the serum. Through the kindness of Dr. Martin, I obtained several from the Lister Institute; from Dr. Robertson I received some from Birmingham; I also received cultures from Professor Beatty's laboratory in Liverpool, and from Professor McWeeney, of Dublin. Most of these I tried to take out in sealed tubes, but they all died off on the voyage; I had, however, taken a small

incubator, and transplanted samples from all these places on the voyage, so that strains from the various districts were available for comparison. They showed no marked differences, when compared with those in use in the preparation of the serum now being made at the Rockefeller Institute. Some of them did not agglutinate with the serum in quite so high dilutions as those in use there, and these have been used in the preparation of the serum now. With the recent improvements in culture media, interchanges of cultures for comparison should be less difficult.

(4) Was the serum available of as high a standard of immunity value? For two or three years before our epidemic last winter, there had been very little demand for the serum from the sources of supply in America; then suddenly came the great demand from this country. Our War Office ordered large quantities, and much was requisitioned from France, with the result that the available horses were bled as frequently as possible and the immunity value of the serum dropped very seriously. For this, and possibly for other reasons, I think there is no doubt that much of the serum which reached this country last winter was of a much lower standard of value than that formerly supplied. *I think here lies the true reason of the somewhat disappointing results sometimes obtained from its use.* Steps have been taken to correct the deficiency in the quantity and the quality of the serum. Dr. Flexner, too, has again taken up the preparation of serum at the Rockefeller Institute, and that now available, judged by all the laboratory tests, is of higher value than any formerly in use. I brought back with me a supply of this new serum, and, so far, I have treated eight acute cases with it. In these there has been one death. This is very promising, but is much too small a number to judge by. Some of these eight cases were comparatively mild, but some were quite severe types. The latest case, a soldier, admitted nine days ago, then 24 hours ill, was deeply unconscious with normal temperature, cyanosis, stertorous breathing, and the dreaded slow pulse. On puncture, thick syrupy pus was obtained. He was given 40 c.c. of serum; next day he could be roused, but had paralysis of one side of the face, and, on the following day, paralysis of the arm on the same side. He then steadily improved, and when I saw him yesterday he was quite bright, the paralysis of face had cleared up, that of the arm nearly so,

and the meningococcus had disappeared from the fluid. He appeared on the fair way to rapid recovery. He was given five injections of serum, 140 c.c.s. in all.*

It would be interesting to have views on the advisability of taking continuous blood-pressure readings during lumbar puncture and the injection of the serum, as insisted upon by Sophian, as well as on the use of general anæsthetics. I confess that when I first read Sophian's note on the value of blood-pressure readings, and on the danger of general anæsthetics, I felt uneasy. I had not at that time—some three years ago—had any cases for a considerable period, but I felt that possibly the cases I had treated had not got the best chance; for I had never been guided by blood-pressure readings, either in fixing the quantity of fluid drained off or in the dosage, and I had generally given chloroform.

Early in my experience I received a lesson which I have not forgotten. I did not like giving chloroform to these patients so frequently, though the patients so often asked for it. In one of the first cases I ever had—a powerfully-built man—I had given chloroform at the first injection; when repeating the injection, I explained to him what I was about to do, and he consented to bear it without moving if possible. He allowed me to puncture him with quite a large trocar without fuss; the fluid came freely, and all was going well, when suddenly—I suppose through some slight movement of the trocar—he felt what was evidently excruciating pain. He sprang off his side, and made desperate efforts to bury his back in the bed, so that I would not again be able to touch the trocar. He was immensely muscular; I had one assistant and a nurse, but I was very greatly relieved when I at length succeeded in getting the trocar removed. I completed the injection under chloroform. Since then I have always used a general anæsthetic, unless the patient was unconscious, or in a few cases when there seemed to be some contra-indication. From my experience of some 800 or 1,000 injections, quite 80 per cent. of which have been done under general anæsthesia, I believe these patients give no more anxiety to the anæsthetist than any others, and I would recommend the use of a general anæsthetic, unless when obviously unnecessary or for some reason contra-indicated. I have not been able to obtain suc-

* This case has made a complete recovery.

cess with "water anæsthesia," as recommended by Sophian.

In some cases, I tried taking continuous blood-pressure readings, but did not think I received any help from them. With general anæsthesia, the variations in pressure do not seem to be marked either during the withdrawal of fluid or the injection of the serum. The withdrawal of fluid often gives rise to very severe pain, and, as Sophian says, the injection at times gives rise to pain which may be almost unbearable. I think the explanation of many of the alarming variations in blood-pressure is to be found in this sudden severe pain set up. With general anæsthesia this is avoided. As the result of his experience in this method of control of dosage, Sophian found that much smaller doses of serum appeared to be the safer course, and recommends that, in young children, the dose should be 3 to 12 c.c. In my cases in young children, I have always given the full dose of 20 c.c.—often more—generally under complete anæsthesia, and the results have been quite good. In the series are included two children under one year—both recovered. These were not mild cases. One, aged six months, admitted on the fifth day, required seven injections, the last on the 19th day; this case received in all 150 c.c. of serum, viz., six injections of 20 c.c. and one of 30 c.c.

The best dosage for any age, infant or adult, has not been as yet worked out. Personally, I am inclined to give full doses, and to repeat them frequently until definite improvement is shown. I am quite sure we often use more serum than is necessary, but at present we have no means of estimating the risk of withholding it in cases not distinctly improving.

Though I must confess to some disappointment with the results in this series of cases, and with the mortality of 36 per cent., I think there can be no doubt that, should there be a recrudescence of the disease in this winter, we may look forward to having available serum of much higher value than much of that employed in this country last winter.

(c) BY H. D. ROLLESTON, M.D., F.R.C.P.

Surgeon-General (Temp.) Royal Navy; Senior Physician, St. George's Hospital, etc.

FROM the commencement of the war to July 31st, 1915, there

were 170 cases of cerebro-spinal fever in the Royal Navy. The following is a summary of the results of treatment in 163 cases, 89 of which (or 54·6 per cent.) proved fatal:—

	Cases.	Deaths.	Recoveries.
<i>Antimeningococcal serum.</i>		Per cent.	Per cent.
Intrathecally - - - - -	105	64 or 61·0	41 or 39
Alone - - - - -	62	43 „ 69·4	19 „ 30·6
Combined with vaccines, soamin, hexamine, or serum hypodermically -	43	20 „ 46·5	23 „ 53·5
Combined with soamin - - -	18	11 „ 61·0	7 „ 39·0
„ „ an auto-vaccine -	11	2 „ 18·2	9 „ 81·8
„ „ hexamine - - -	7	5 „ 71·4	2 „ 28·6
„ „ serum hypodermically.	7	2 „ 28·6	5 „ 71·4
Hypodermically - - - - -	19	6 „ 31·6	13 „ 68·4
Alone - - - - -	4	1	3
Combined with intrathecal injection of serum - - - - -	7	2	5
Combined with auto-vaccine and intrathecal injection of serum -	4	1	3
Combined with an auto-vaccine -	3	2	1
„ „ soamin - - - - -	1	0	1
<i>Autogenous vaccine</i> (never alone) - -	16	4 or 25·0	12 or 75·0
Combined with serum intrathecally -	6	1	5
Combined with serum intrathecally and hypodermically - - - - -	4	1	3
Combined with serum intrathecally and soamin - - - - -	1	0	1
Combined with serum hypodermically -	4	2	2
„ „ soamin - - - - -	1	0	1
<i>Soamin</i> - - - - -	43	19 or 44·0	24 or 56·0
Alone - - - - -	21	7 „ 33·3	14 „ 66·7
Combined with serum intrathecally -	18	11 „ 61·0	7 „ 39·0
Combined with serum intrathecally and hexamine - - - - -	1	1	0
Combined with serum intrathecally and vaccine - - - - -	1	1	0
Combined with serum hypodermically -	1	0	1
„ „ auto-vaccine - - -	1	0	1
Lumbar puncture (alone) - - - -	13	4 or 30·8	9 or 62·2
Symptomatic treatment (only) - -	14	10 „ 71·4	4 „ 28·6

Naturally, the prolonged and unsatisfactory cases received more varied treatment than the fulminating ones. Some of the latter died shortly after arriving at hospital. The most

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163 cases, though in 38 once only, but 14 of these died soon after coming under observation. Six of the other cases, which had a single tapping, died. Of 22 cases tapped twice, 8 died. Three tappings were done in 20 cases, with 9 deaths; 4 in 24 cases, resulting in 15 deaths. Lumbar puncture, he regarded as a palliative rather than as a curative measure, by relieving symptoms due to increased intrathecal pressure. In 13 cases, of which four proved fatal, it was the only form of treatment other than the ordinary symptomatic remedies employed.

In 14 cases, 10 of which proved fatal, symptomatic remedies only (such as morphine for pain) were given.

With regard to prophylactic measures, it seemed advisable to invalid the men who recovered from an attack of the disease, because they might be intermittent or periodic carriers who alternately gave negative and positive results on bacteriological examination of throat swabs for meningococci. Recently, three cases of the disease among boys were traced to a boy who had recovered from the disease, and, when examined bacteriologically, was found to be a carrier.

(d) BY MICHAEL G. FOSTER, M.D., CAPT. R.A.M.C.

First Eastern General Hospital, Cambridge.

EARLY in the epidemic, the Commanding Officer set apart a ward for the treatment of the disease under discussion, and cases were collected from practically all over the Eastern counties and the South Midlands. The first case came under notice about the middle of January—an officer's servant, who was at his work the night before, and, at 2 a.m., was found in bed unconscious. He was moved to hospital with the provisional diagnosis of uræmia. On arrival, he was profoundly unconscious, had tremors all over, could not swallow, and had nystagmus and retention of urine. Only $1\frac{1}{2}$ oz. of urine could be obtained by catheter, and it contained neither sugar nor albumen. Lumbar puncture yielded an ounce of yellowish fluid containing pus. As the bacteriologist had not made his report next day, the theca was again punctured, and $1\frac{1}{2}$ oz. of fluid drawn off. On the third day, the man was definitely

noticeable feature about the tabulated particulars was the failure of the intrathecal injection of antimeningococcic serum, though this was obtained from various sources. The cases treated solely by the intrathecal injection of serum and lumbar puncture showed a higher death-rate than that of the whole 163 cases. Flexner, in the *Journal of Experimental Medicine*, 1913, emphasized the importance of injecting antimeningococcic serum intrathecally as early as possible in the disease. In a table of 1,211 cases, he showed that when the serum was injected within the first three days, the mortality rate was 18 per cent.; when between the fourth and seventh days, 36·5 per cent.; and when later than the seventh day, 36·5 per cent. A comparison on the same lines of the cases in the Royal Navy showed:

	Cases.	Deaths.	Recoveries.
1st to 3rd day ...	70	42 or 60 per cent.	28 or 40 per cent.
4th to 7th day ...	24	14 or 58·4 per cent.	10 or 41·6 per cent.
Later than 7th day	11	8 or 72·7 per cent.	3 or 27·3 per cent.

The failure of the injected serum to reduce the mortality clearly was not due to its being given too late. The serum treatment, which was so successful in the hands of Flexner and Sophian in America and of Robb in Belfast, was given a thorough trial in these cases, but proved most disappointing. Possibly the meningococci were "fast" to the action of the serum, or the organisms were para-meningococci. Alarming symptoms directly after the intrathecal injection occurred in two cases only, showing that the gravity method of administration (which was not in vogue in the Royal Navy) was scarcely necessary when due care was taken. Serum rashes were noted in 20 per cent. of the cases, but may have been more frequent; in a few cases, there were also arthritic pains. No severe anaphylactic symptoms were recorded. In the 16 cases in which Fleet-Surgeon White-side, R.N., gave an autogenous vaccine, the low mortality of 36·7 per cent. was reached. Soamin seemed to give good results, and to have a beneficial effect in the septicæmic stage. Optic atrophy was not noted in any instance, though in one case 42 gr. were given. Hexamine did not appear to exert any effect clinically, and was therefore soon abandoned. Lumbar puncture was performed in 149 of the

puncture would prevent hydrocephalus being set up. If the theca could be kept properly drained, there seemed a reasonable chance of a successful result. It is a very safe operation, but I agree with Dr. Robb that it is very difficult to ensure doing it properly without a general anæsthetic. The greatest quantity of fluid which either my colleague, Captain Gaskell, or myself has withdrawn is 2 ozs., and no sign of collapse followed.

(e) By J. F. GASKELL, M.D., F.R.C.P., D.P.H., CAPT. R.A.M.C.

First Eastern General Hospital, Cambridge.

THE fifteen fatal cases mentioned by Captain Foster were all examined post-mortem, and could be divided roughly into three groups: *acute fatal cases*, which did not respond to treatment and succumbed within five days; *sub-acute cases*, dying three to four weeks after onset; and *chronic cases*, lasting six weeks or more, which died with hydrocephalus.

In the *acute cases*, pus was found not merely at the base of the brain, but distributed all over the vertex in the sub-arachnoid space round the blood vessels, a most intense vertical meningitis being present, the whole of the meninges being greatly engorged. Even in fulminating cases, in which the disease had lasted less than 48 hours, a considerable amount of pus was present round the cerebral vessels over the vertex. The pathological condition was such that recovery from it would seem to be almost out of the question. Two of the *sub-acute cases* lasted for about three weeks. At the post-mortem, a most tenacious, inspissated, purulent exudate completely covered the base of the brain, and filled the sub-arachnoid space of the cord. In contradistinction to other cases, excess of cerebro-spinal fluid was entirely absent. Pus was present over the vertex, but in comparatively small amount; the cerebral vessels were not congested. In these cases, lumbar puncture had been performed repeatedly, but the amount of pus present, instead of diminishing, had progressively increased, until finally the fluid became so thick that it would no longer flow through the largest puncture needle. After this, only a drachm or two of thin serum could be obtained. In one of these cases, serum was used in an attempt to dilute the pus, but was entirely without effect.

better. The diagnosis being still uncertain, he was again punctured. The following day he could swallow, and had recovered consciousness. On the sixth day he was well and was discharged. On the twentieth day, he returned to duty. Two other cases occurred within a day or two, from the same regiment. They also were punctured and both recovered, but after a somewhat tedious course. The staff then began to employ serum; six cases were treated with it, and two were admitted from outside after having received an injection. Of the eight cases, four died. They concluded that they were not doing very well with the serum, and, bearing in mind the good result from simple lumbar puncture in the first, very acute, case, they treated all the succeeding cases in that way, repeating it as often as the symptoms persisted. By the end of March, 28 cases had been treated, most of them by lumbar puncture. Twenty cases were treated without serum, and there were four deaths, though in the next seven cases there were five deaths. About that date, there seemed to be a peculiarly virulent type of case. Towards the end of the epidemic, they had a series of nine cases with only one death. During the time I had charge of the ward, *i.e.*, to the middle of June, there were 42 cases, 14 deaths.

I submit that frequent drainage of the cerebro-spinal fluid during the persistence of the symptoms is a satisfactory form of treatment, at all events until a more satisfactory serum is available than there now seems to be. The simple procedure resulted in a very striking relief of symptoms, especially of the very intense headache. A most important matter was the prevention of hydrocephalus. Some of the fulminating cases were absolutely unresponsive to anything. Many cases seemed to recover up to a certain point, then had a return of severe headache, and relapsed, ending in death. The onset of hydrocephalus may be marked by a sudden lapse into an adynamic state with feeble pulse and unconsciousness. The supervention of these symptoms is a sign of increased cerebro-spinal pressure, and an indication for lumbar puncture. Post-mortem, one found that the cord was so tightly bound across that there was no circulation, explaining the impossibility of getting anything from the cord by puncture. I believe that in many cases daily

THE CAUSES AND PREVENTION OF EPIDEMIC CEREBRO-SPINAL MENINGITIS.

BY HALLIDAY SUTHERLAND, M.D., TEMP. SURGEON ROYAL NAVY.

Fellow of the Royal Society of Medicine ; Consulting Tuberculosis Officer for North Marylebone, and Medical Officer to the St. Marylebone Tuberculosis Dispensary.

EPIDEMIC cerebro-spinal meningitis is an acute systemic infection, characterized by gross inflammatory lesions in the meninges of the brain and spinal cord, although not limited to these areas. The causal organism, the diplococcus intracellularis meningitidis, probably passes from the naso-pharynx *via* the cervical lymph chains to the blood stream, and is thus carried to the meninges and to all parts of the body.

Meningococci are found in the naso-pharynx of patients, in the throats of a variable number of contacts or those exposed to infection, and in the throats of a small number of healthy persons not so exposed. These facts led Andrewes¹ and others to an important advance in ætiology—"the disease does not spread as a meningitis; what is spread is the meningococcus; the meningitis is an accident, which happens in only a certain proportion of those invaded by the meningococcus."

Predisposing causes.—Predisposing causes of the malady were found in conditions of overcrowding, overfatigue, naso-pharyngeal catarrh, and of inadequate ventilation. Sims Woodhead² reported that the epidemic at Cambridge last winter was checked by effective ventilation of the huts in which the cases occurred. Again, the disease, unknown in the Arctic circle, has a relation to cold atmospheric conditions in temperate climates, and epidemics mostly occur during the months of February, March, or April, disappearing with the advent of May.

Ætiology.—The actual conditions under which the disease arose and was transmitted remained obscure. "Of the causes of the outbreaks, whether increased virulency in a widespread germ, or increased susceptibility under changed atmospheric

These cases had initially responded to treatment, but had finally sunk into an adynamic state. In this class of case, the purulent infection had apparently paralysed the cerebro-spinal secretion.

In the *chronic* group, marked symptoms of hydrocephalus were present in life, and, post-mortem, the third and fourth ventricles were found to be widely dilated and filled with fluid. The lateral ventricles were also, as a rule, distended. In two cases, the sub-arachnoid space was completely obliterated by adhesions in the upper dorsal region. Lumbar puncture had, therefore, failed to relieve the distension of the ventricles. In another case, the roof of the fourth ventricle had become completely adherent to the cerebellum. In yet another case, no complete obstruction in the cerebro-spinal circulation was found, but a terminal pneumococcal septicæmia was present.

A common cause of death was respiratory failure; the heart could be kept beating by artificial respiration for some hours.

The efficacy of daily lumbar puncture, commenced as early as possible in the illness, was demonstrated in the cases which had recovered, those punctured on the first or second day having a comparatively short illness. Some had not been punctured before the eighth day, and, in these, the illness had run a very prolonged course. One of these prolonged cases had ceased to show further signs of illness after 5 c.c. of his own serum had been injected intrathecally. This form of treatment was tried, because the agglutinating power of the man's own serum had been found to be much higher than that of any of the artificial immune sera. This effect may have been merely a coincidence, for other chronic cases had similarly ceased quite suddenly to show symptoms. It is, however, intended to test the treatment further. The net result of the cases at the hospital is a mortality of 39 per cent., and most of the cases were treated by lumbar puncture, unsupplemented by any other form of treatment. I contend that the details of the cases showed up as well under that simple procedure as other series in which lumbar puncture and the injection of serum had been carried out.

scopically and by subculture the presence of a Gram-negative diplococcus—growing at 37° C. but not at 22° C., fermenting glucose-litmus-peptone-ascitic-broth but not a similar saccharose broth—the diplococcus meningitidis. A growth was obtained daily on Nasgar for 10 days.

A subculture made on the fourth day, Y, after 24 hours' growth was again subcultured, Y₁, and this showed typical meningococci. On subculture, Y₂, colonies of meningococci attained the size of 1 m.m. in six hours, and this rapidity of growth was also noted in Y₃. When Y₄ was examined microscopically, the growth consisted of swollen ill-stained diplococci, a Gram-negative and a Gram-positive bacillus. This was the fifth subculture of a four days' growth on the broth. Again, in the second subculture of a five days' growth on the broth, there were *Gram-negative bacilli*, Z₁.

On the sixth day, a subculture, A, was made from the broth, and in this meningococci developed. From this three subcultures, A₁, were made, one being retained, while the second and third were sent to two distinguished bacteriologists, with a statement that the tubes contained meningococci. In the subculture retained, I found a Gram-negative and a Gram-positive bacillus. This was the second subculture of a six days' growth on broth. One bacteriologist reported that his culture contained meningococci, but was "contaminated with a Gram-negative bacillus which must have been an accidental contamination whilst subculturing." He added that the contaminated culture conformed to the fermentation tests for the meningococcus. The other found no meningococci, but cocci, a Gram-negative bacillus, and a diphtheroid bacillus, "similar to that found on the skin, and with which the broth was probably contaminated at the time of withdrawing the blood." Lastly, A₁ was kept for six months, and on a subculture, A₂, a *Gram-positive diplococcus* developed. This organism conforms to the fermentation tests for meningococci, but grows at 22° C.

As a further test, spinal fluid was run directly on to a Nasgar plate, and, in 24 hours, small round, flat, opaque colonies, 2 m.m. in width, of meningococci appeared. In five days the colonies were dead. After two days' growth, a subculture, B, of meningococci was obtained, and these, after two days' growth, were again subcultured on Nasgar, B₁. On this, within 24 hours, there appeared a small, white,

or telluric conditions, we are as ignorant as when Sydenham summed up the experience of twenty years' close study of the *genius epidemicus* of London."³ Sir William Osler⁴ made an inspiring suggestion, a further incentive to many, when he wrote, "In cerebro-spinal fever we may be witnessing the struggle of a new disease to win a place among the great epidemics of the world."

Among other views advanced, it was suggested that some blood-sucking insect, such as *pediculis corporis*, might convey the disease.⁵ Again, the daring speculation had been launched that meningococci were a mutation of gonococci, and this view was favoured by the present writer when first discussing the problem with colleagues. The fact that young children contract cerebro-spinal fever was an obvious objection to this theory, which is only recalled here in order to accentuate the true ætiology, depending as it does on a direct relation between factors, all already known but not correlated. In an age, in which thought is not altogether free of systematized confusion and spiritless perplexity, the very simplicity of a truth may operate against its general acceptance.

Pleomorphism of the diplococcus intracellularis meningitidis.
—It is unnecessary to recollect the essential morphological, cultural, and biological features of the meningococcus. Many have noted that the organism tends to assume involuted forms on old cultures. Thus Gordon⁶ writes: "The meningococcus, when growing on solid media, tends to degenerate, so that, in microscopic preparations, a proportion of the cocci are found to take the ordinary aniline dyes feebly." Whether such changes are involuted or degenerated forms, or whether they constitute true pleomorphism as claimed by recent writers, is yet unsettled.

Numerous contributions have been made to the subject, and, as the matter is not yet beyond the region of controversy, reference may be made to my own observations.

From a proved case of cerebro-spinal fever, 20 c.c. of blood were run direct, under aseptic precautions, from the basilic vein into 100 c.c. of sterile neutral-red-glucose-ascitic-broth at a temperature of 37° C., and incubated at 37° C. At the end of 24 and of 48 hours, no growth was apparent either on microscopic examination or on inoculating Nasgar tubes. After 72 hours, the broth showed micro-

even in Pasteur's "world of the infinitesimal small."

This view is speculative, and I am well aware of the limitations and deficiencies of my observations, undertaken at a time when the routine work concerned with the epidemic was heavy. It is very possible that the cultures were contaminated, although I have not been so persistently unfortunate when working with other bacteria. On the other hand, should these results be confirmed, they indicate a pleomorphic cycle from a Gram-negative diplococcus to a Gram-negative bacillus, a Gram-negative diplobacillus, a Gram-positive diphtheroid, a Gram-positive diplococcus, and a Gram-positive bacillus. No success attended an attempt to re-establish a growth of meningococci by growing these other organisms on less nutritive media, and there were no facilities for the final test of animal inoculation, whereby it should be possible to re-establish the meningococcus. Subcultures of Z_1 , A_2 , C, and D, are still growing, and are at the disposal of anyone who cares to make further investigations. Lastly, I wish to acknowledge the skilled assistance in the laboratory of Second Sick-Berth Steward B. R. Lavender, Royal Navy.

Organisms resembling those described have been isolated in cases of cerebro-spinal fever from the urine by Hort, Lakin, and Benians.¹⁰ These authors also found a filter-passing organism in the cerebro-spinal fluid and in the blood, which organism, they suggest, is the immediate ancestor of the meningococcus, and possibly the true infective agent in the disease.¹¹ Shaw¹² isolated micrococci and Gram-negative and Gram-positive bacilli from the blood. Similar organisms were grown from the spinal fluid by R. Donaldson,¹³ who also grew them from the pus in a case of apparent pyæmia, occurring during an epidemic of cerebro-spinal fever. These organisms were inoculated into mice, and three out of four animals died of septicæmia. "Films made from the peritoneal fluid, in addition to the variety of organism inoculated, showed large numbers of a small Gram-negative organism bearing a resemblance to meningococci . . ."¹⁴ Again, such organisms have been found in the naso-pharynx, in the brain, and in the blood by Lundie, Thomas, and Fleming.¹⁵

Donaldson¹⁶ has suggested that the causal organism may be a pleomorphic diphtheroid rod, related to the Klebs-Loeffler bacillus, giving rise to forms resembling Hofmann's bacillus or to meningococci, and that the disease is trans-

opaque, spreading growth with regular margins, which consisted of Gram-negative diplococci and Gram-negative diphtheroid bacilli. The latter, which appeared on the fifth day in the second subculture of a two days' growth on the original plate, were about 2 to 3μ in length, by 1μ in breadth. At each end they stained deeply with Bismarck brown, and there was a clear unstained space in the middle, in some transverse, in others longitudinal. The ends were round, and they resembled a diplococcus in which the separation of the two cocci was not complete, both being joined by part of the original protoplasm. After 48 hours, this subculture showed a luxuriant white, smooth and wavy spreading growth with a serrated filamentous branching margin. Subculture B₂ gave a similar growth, as did B₃, which also grew on Nasgar at 22° C. and on gelatine at 22° C. without any liquefaction. The latter showed ill-staining diplococci, Gram-negative bacilli and diplobacilli, Gram-positive diphtheroids and long bacilli. Finally, B₃ was kept for six months, and, on a subculture, C, a *Gram-negative diphtheroid bacillus* developed. Subculture B was also kept for six months, and on a subculture, which, to avoid confusion, may be termed D, a *Gram-positive diphtheroid bacillus* developed.

These subcultures cannot be regarded as degenerated cultures of meningococci. Either the meningococcus, grown on a rich medium, rapidly reverts to simpler and more luxuriant forms of growth, or the subcultures became contaminated with extraneous organisms.

In favour of the first proposition it may be recalled that the tubercle bacillus, an organism firmly established in nature, and whose morphology remains unchanged even when subcultured for years, has been reported to change its shape when grown in a sperm-oil medium.⁷ It has also been noted that, whereas a 14 hours' growth of meningococci will be agglutinated with an immune serum, a 48 hours' growth is not agglutinated.⁸ This seems to point to a rapid change in the bio-chemistry of the organism, when grown outside the body. Colebrook⁹ has further shown the antagonism of pneumococci to meningococci, and that a growth of the latter may be inhibited by some bacteriacidal substance secreted by the pneumococcus. All these circumstances rather point to instability of the meningococcus, and it may be that this organism has not yet established a firm place

even in Pasteur's "world of the infinitesimal small."

This view is speculative, and I am well aware of the limitations and deficiencies of my observations, undertaken at a time when the routine work concerned with the epidemic was heavy. It is very possible that the cultures were contaminated, although I have not been so persistently unfortunate when working with other bacteria. On the other hand, should these results be confirmed, they indicate a pleomorphic cycle from a Gram-negative diplococcus to a Gram-negative bacillus, a Gram-negative diplobacillus, a Gram-positive diphtheroid, a Gram-positive diplococcus, and a Gram-positive bacillus. No success attended an attempt to re-establish a growth of meningococci by growing these other organisms on less nutritive media, and there were no facilities for the final test of animal inoculation, whereby it should be possible to re-establish the meningococcus. Subcultures of Z₁, A₂, C, and D, are still growing, and are at the disposal of anyone who cares to make further investigations. Lastly, I wish to acknowledge the skilled assistance in the laboratory of Second Sick-Berth Steward B. R. Lavender, Royal Navy.

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mitted, not by the meningococcus, but by one of its more resistant forms. Against this view is the fact that meningococci are found not only in the throats of a certain proportion of contacts, but also in the urine¹⁷ of some who are not suffering from the disease. This means that the organism may exist as a harmless saprophyte. Now, under conditions presently to be described, it is possible for meningococci, in spite of their feeble resistance, to be conveyed from one person to another, and, moreover, the evidence led in favour of pleomorphism, suggestive as it is, does not yet amount to scientific proof. Again, it has yet to be demonstrated that these pleomorphic forms are pathogenic to man, for bacteria giving an easy luxuriant growth are generally of low virulence.

The place of the carrier.—The word "carrier" is a comparatively recent medical neologism, not found in the New Sydenham Lexicon. It means a person, either healthy or suffering from a mild unrecognized form of disease, who transmits the causal organism of that disease to susceptible people, and to that person an epidemic may therefore be traced. In this sense, we have typhoid and diphtheria carriers, but it will be seen that the definition does not strictly apply to carriers of meningococci.

A variable percentage of those living in relation to patients have been found to carry the meningococcus in the naso-pharynx, as shown in the following table:—

	Per cent.	Contacts.
Bruns and Hohn ¹⁸ found	36.9 of carriers among	609.
Black ¹⁹	" 28.3	" 801.
Whiteside ²⁰	" 27.3	" 340.
v. Lingelsheim ²¹	" 9.5	" 264.
Sutherland ²²	" 4.2	" 95.

A few instances have been recorded in which a carrier, not himself suffering from the disease, transported infection from a patient to another person who developed the malady.^{23, 24} Nevertheless, transmission of the disease from one case to another through a carrier is most uncertain, and it is impossible to trace this route of infection between sporadic epidemics occurring in different localities. Rolleston²⁵ made an exhaustive inquiry as to the possibility of infection having been conveyed from the Canadian Camp at Salisbury to the R.M.A. Barracks, Eastney, but found

that, to establish any connection between the two epidemics, it would be necessary to postulate the existence of two carriers, neither of whom himself contracted the disease.

There are further difficulties in accepting these meningococcal carriers as carriers within the meaning of our definition. It has been noted ²⁶ that, out of 1,957 houses in which cases of the disease occurred, in only 6.9 per cent. of these houses was there more than one case. Again, Sir William Osler ²⁷ has pointed out the constant sporadic presence of this disease as the posterior basic meningitis of children, and as an acute meningococcal meningitis of young adults.

Nor are those who carry the organism entirely immune from the disease. Whiteside ²⁸ has made the valuable observation that, of 167 carriers detained in hospital, two developed the malady. The number is small, and may possibly be explained by the routine disinfection of the throats of all his carriers. It also indicates that the organism may exist in the throat as a harmless saprophyte. In this it resembles the pneumococcus, saprophytic so long as it cannot overcome the resistance of the tissues, but pathogenic when the resistance of the body has been lowered. Lastly, Mayer and Waldmann found that two per cent. out of 9,111 healthy soldiers, not exposed to infection, in the Munich garrison at a time when the disease was not prevailing, were carriers of meningococci.²⁹

Ledingham ³⁰ has objected to the generalization that two per cent. of healthy people carry the meningococcus as an ubiquitous germ. Admitting the accuracy of the figures, he argues that some of the carriers revealed at the meningitis-free period had been chronic carriers since the last epidemic, whilst others had been infected by such carriers. Even so, this does not appear to be an unsurmountable objection to the generalization, and it is difficult to subscribe to the view that the acceptance of this generalization is tantamount to placing cerebro-spinal fever on the same plane as pneumonia, where epidemiology does not come in. While two per cent. of the normal population may be carriers of meningococci, 100 per cent. of healthy people are carriers of pneumococci. May the day never dawn when the meningococcus has the malevolent omnipresence of the organism which now carries the Captain of the Men of Death, and until then, epidemiology will have a place, but a limited place, in the

causation of cerebro-spinal fever. The evidence about carriers led Arkwright³¹ "to the conclusion that the statement that cases of meningitis occur when and where carriers of the meningococcus become numerous, is a more correct way of stating the facts than by saying that many carriers occur in the neighbourhood of cases of meningitis."

It would be better, for accuracy of expression, if the word "carrier" were disregarded in this disease, and that those who spread meningococci should be called infecters ("Infecter,"³² he who or that which infects," using the word "infect" in the sense of tainting with morbid or noxious matter).

On all the evidence, it appears probable that a small percentage of the healthy population harbour meningococci and, under certain conditions, spread, not the disease, but the meningococcus, thus increasing the number of those in whom the disease may develop under these same conditions.

Conditions determining the spread of infection and the incidence of the disease.—Apart from the question of pleomorphism, it would seem that the meningococcus is an unstable organism, of high potential virulence, but of short life outside the body. A temperature of 72°·2 F. is incompatible with growth of the germ, which soon dies. I found that pure cultures of meningococci were killed in 30 minutes by a temperature of 62° F.—a frequent atmospheric reading in winter and in spring—and that lower temperatures were more rapidly fatal. It was thus obvious that infection could never be carried by cold air. Cold air kills the organism, but cold weather favours the disease. In the solution of that paradox, the ætiology of the disease became as clear as the means of prevention.

Physiological overcrowding.—Elsewhere,³³ a distinction has been made between legal and physiological overcrowding, and it has been shown that in ships, barracks, and camps, cold weather leads to shutting off the natural, and sometimes the artificial, means of ventilation, whereby any legal overcrowding is converted into physiological overcrowding, which is the determining factor in the causation of the disease.

Influence on pleomorphism or on pathogenicity.—Whether we assume that the malady arises by the conversion of a diphtheroid bacillus, inhabiting the naso-pharynx, into the

meningococcus, or by the development of pathogenic properties in saprophytic meningococci already present in the throat, the resistance of the body tissues is an essential factor in this change. Under conditions of physiological overcrowding in cold weather, the vitality of the tissues has been depressed, first by cold, and, secondly, by warm, stagnant air. The reduction in oxygen and the increase of CO_2 , even if the latter be not sufficient to act, as a direct poison on the blood, throws an increased strain on the cardiac and circulatory systems. Again, an atmosphere, the temperature of which approximates to that of the body, has been shown to increase the volume of blood in the peripheral circulation at the expense of the internal metabolism.³⁴ Such a condition of the body is likely to offer a lowered resistance to the development of pathogenic properties in a saprophytic organism.

Favouring the spread of infection.—Under circumstances in which the temperature of warm, impure, saturated air is raised by the natural heat of the body to 80° F. or over, the life of any meningococci, expelled from the mouths of patients or of infectors in the act of coughing, is prolonged. Infection is thus carried from one person to another by warm currents of moving air, which explains the fact that persons sleeping on one side of a patient may be infected, while those on the other side escape. It is also significant that the largest percentages of infectors have always been associated with conditions favourable to physiological overcrowding.

Favouring invasion of the tissues.—Overheated, saturated air predisposes to bacterial infection of the naso-pharynx, since the nasal mucosa becomes red and turgid, while the increased circulation causes excessive secretion of mucus. This forms a nidus for inhaled bacteria, and prevents their destruction by the cellular elements of the mucosa. When the individual passes thence into cold air, the cleansing action of the ciliated cells and the phagocytic properties of the mucosa are further inhibited.³⁵ The excessive use of tobacco doubtless may be a contributing factor, but, apart from this, naso-pharyngeal catarrh is frequent among infectors and patients.

Favouring lowered resistance to the disease.—Physiological overcrowding reduces the internal metabolism of the body,

while putting an extra strain on the heart and lungs; subsequent exposure to cold, which in itself may depress the nervous system to the extent of severe vaso-motor collapse, will further reduce the vitality of the tissues, and to this overfatigue may also contribute. These combined factors complete the ætiology of the disease.

Prevention.—The greater the legal overcrowding, the more thorough should be the natural means of ventilation in dormitories, in day rooms, or in tents. All windows must be kept open day and night, and, to prevent the necessity for closing them owing to strong winds, it is well to have a weather-board fixed outside the windows at an angle of 45°, which ensures that they may be kept open three feet at the bottom in all weather conditions.

Cold is to be guarded against by suitable clothing, by woollen underwear, thick socks, fur-lined gloves, sleeping stockings, and, if necessary, by hot-water bottles.

As damp garments draw heat from the skin, all clothing must be dry, and drying rooms, available for wet boots and clothes at all times, should be provided. The evil conditions of physiological overcrowding are all present, when wet clothes can be dried in a sleeping room, where the heat is generated by the perspiring bodies of the occupants in close, confined air.

The larger view.—There is a larger aspect of these physiological laws determining both the ætiology and prevention of this disease, for they indicate how great are the possibilities in the further extension of the principle of ærotherapy. Sir Robert Philip³⁶ has long urged the widest application of open-air measures in the practice of medicine. At an earlier date, attention was drawn to the value of efficient ventilation in maintaining the health of the Forces of the Crown. As far back as 1757, James Lind,³⁷ a distinguished naval surgeon, wrote: "Proper ventilation abates the malignity, lessens the mortality, and averts the progress of highly contagious or pestilential fevers;" and he also tells of patients who, during a war, were housed in huts erected in the fields. "These poor fellows were thought to be badly accommodated, but it was very observable that most of them who lay in the cold huts recovered, when the mortality in the hospital due to hospital fever was so great that, in some wards, not one in three escaped."

In 1758, Brocklesly, an army physician, noted the remarkable recoveries and speedy convalescence of soldiers housed in a deal shed with a straw roof, so badly constructed that the interior was much exposed to wind and weather.³⁸

The story of cerebro-spinal fever reveals the forces of nature fighting against the disease at every turn, and implacably opposed to the existence of the organism, while man alone, of his own will and folly, is seen to be harbouring infection and creating the only conditions under which the malady can appear. For the moment, it may seem strange that a disease, the ætiology of which is simple and its prevention so easily attained, should be so difficult to cure when once established in the body, and should be possessed of such malignant virulence. For example, a young soldier who paraded at eight in the morning was carried dead into hospital at six the same night. At the *post-mortem* examination, his fine physical development was apparent, and the scene recalled something of the helplessness of humanity, in days when the grotesque shadows of "The Red Death," "The Black Death," and "The Blue Mist" were passing over the world. In the war now successfully waged against these maladies, the old military maxim has held true, that the best defensive is an offensive, and of the wherefore and the why, there is an apposite passage in the wise teaching of Sir William Gull ³⁹ :—

"Causes affecting health and shortening life may be inappreciable in the individual, but sufficiently obvious when their effect is multiplied a thousandfold. If the conditions of society render us liable to many diseases, they in return enable us to establish the general laws of life and health, a knowledge of which soon becomes a distributive blessing. The cure of individual diseases, whilst we leave open the dark fountains from which they spring, is to labour like Sisyphus, and have our work continually returning upon our hands. And, again, there are diseases over which, directly, we have little or no control, as if Providence had set them as signs to direct us to wider fields of inquiry and exertion. Even partial success is often denied, lest we should rest satisfied with it, and forget the *truer and better means* of prevention."

That is not the language of rhetoric. It may indeed be, on account of unhygienic conditions created and fostered by

while putting an extra strain on the heart and lungs; subsequent exposure to cold, which in itself may depress the nervous system to the extent of severe vaso-motor collapse, will further reduce the vitality of the tissues, and to this overfatigue may also contribute. These combined factors complete the ætiology of the disease.

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CEREBRO-SPINAL FEVER.

By SHEFFIELD NEAVE, M.R.C.P., M.R.C.S., TEMP. CAPTAIN R.A.M.G.

Late Travelling Pathologist, Government of Sudan, etc.

THE recrudescence of this disease last winter and spring, accompanying the collection of soldiers for the purposes of the war, has given further opportunity of studying it, and has brought out some excellent summaries of the facts known to us. Now that a second winter is upon us under the same circumstances, it behoves us, after marshalling the above facts, to consider how we may add to them, in view of the rush of cases which may very well now come. To this end it may be of use to enumerate and consider some of the difficulties that have to be surmounted, and the lacunæ in our information.

The methods of treatment and their results, as given by a report lately published in respect of the cases in the Navy during the last epidemic, do not appear to have been very successful, and the smaller number of deaths per case-incidence at the end of an epidemic appears to be due to some natural cause rather than to success of treatment. This is not a little due to the fact that the disease is seldom diagnosed, until there are signs of the cerebro-spinal system having been affected; in fact, the clinical signs by which the disease is at present diagnosed prove this to be the case. Hence, an earlier method of diagnosis during the preliminary malaise which often occurs is much to be desired. To attain this object, it is obviously a most important matter to study the life history of the organism in the body.

In taking into account the other organisms which attack the meninges, we find that none of them, like the meningococcus, has its seat of election there, but, while preferring other organs for the main attack as a rule, yet affect the meninges from time to time, and sometimes as a sequel to the original attack. This may be said of the typhoid bacillus, the pneumococcus, and the tubercle bacillus.

We are much in the dark in these diseases, as well as in cerebro-spinal fever, as to how and in what order the organisms travel and affect the various parts of the body, including the meninges. Thus, it has been shown that the typhoid bacillus and the pneumococcus can exist, during the diseases they cause, in the cerebro-spinal fluid without causing

an ignorant civilization, that we are now witnessing the physiological evolution of a new disease, or, in simple words, that a tenth plague has been threatened. "And I will harden Pharaoh's heart, and multiply My signs and My wonders in the land of Egypt."⁴⁰

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In taking into account the other organisms which attack the meninges, we find that none of them, like the meningococcus, has its seat of election there, but, while preferring other organs for the main attack as a rule, yet affect the meninges from time to time, and sometimes as a sequel to the original attack. This may be said of the typhoid bacillus, the pneumococcus, and the tubercle bacillus.

We are much in the dark in these diseases, as well as in cerebro-spinal fever, as to how and in what order the organisms travel and affect the various parts of the body, including the meninges. Thus, it has been shown that the typhoid bacillus and the pneumococcus can exist, during the diseases they cause, in the cerebro-spinal fluid without causing

meningitis. In the same way, we are not sure whether the meningococcus reaches the meninges by a direct route from the naso-pharynx, or whether the septicæmia that occurs is a preliminary to the blood infection of that tissue; though those fulminating cases, which apparently die more of toxæmia than anything else, point to this latter method.

Again, as to the problem of infection and the spread of the disease, the same facts are badly wanted. We want to know whether the virulence of the organism varies, and thereby causes merely a slight catarrh in one case and meningitis in another, or whether the tissues of the different patients are more responsible for the passage of the organism in the body by their own idiosyncrasy and variation, *e.g.*, of the prolongation of the sheath of the cranial nerves or of the construction of the ethmoidal sinuses, or, again, of the power of resistance of the anti-bodies in the blood.

The solution of these problems probably lies chiefly in the results of a large number of careful *post-mortem* examinations, in addition to the usual pathological inquiries during life. Again, the statement that a large percentage of contacts harbour the meningococcus in the naso-pharynx seems to require further corroboration now that some place these as low as 5 or 6 per cent. The discrepancy seems to some extent to be due to different methods of detection and recognition of the organism, but it is of importance, under these circumstances, to keep the mind open to other possible methods of transmission than is implied by the original view as to the large percentage accepted hitherto, more especially as it is not usual for a contact to contract the disease.

An unexplained fact in the ætiology of this disease is, that it is unusual for more than one case to occur in a house, although occasionally there may be as many as six from one domicile, in this way following the rule of scarlet fever and diphtheria. Where there is only one case, it would point to the idiosyncrasy of the victim, and where there are many, to the special virulence of the strain of meningococcus, perhaps, but we have proof of neither of these. In the first case, we are only likely to arrive at a solution by the careful investigation of the household and their previous movements, but a thorough investigation is seldom practicable. In the second case, Gordon's work (*J.R.A.M.C.*, Vol. 24,

p. 455) may very well lead to a system of identification of various strains, together with the comparison of their virulence. This identification would help us also, in many cases, to trace whence the infection came. Thus, if the organism from a number of cases in the neighbourhood was agglutinated by the same serum, we might suppose that they had the same origin, while a new comer would probably require a different serum.

As we have seen above, it is seldom that we have an opportunity of treating this disease until meningitis has set in, and the meningococcus is established in the cerebro-spinal system. Treatment by serum does not seem to have been as successful in this country as generally appears in text-books; this is well evidenced in the report on the Navy cases mentioned above. Under these circumstances, when we are only able to attack the invader after he has got well hold of the nervous system, the local application of medicaments is probably the most important method we have. This is only in its infancy, but it appears to present a safe field for the exhibition of drugs and sera. When in Katanga, the writer had many cases of trypanosomiasis in the meningitic stage, and injected, by lumbar puncture, a variety of drugs without any evil results; he is convinced of the safety of the procedure, which would appear to be the path giving the best hope of success in this disease. Washing out with normal saline has been accompanied by recovery.

For G. P. I., injections into the spinal canal of mercury perchloride, gr. $\frac{1}{30}$, is said to have benefited the patient. Balfour's suggestion of introducing the patient's own serum, with the presumed immune bodies, appears well reasoned.

It is claimed that injections of colloidal silver into the spinal canal have been used successfully for meningitis generally by the French profession, and benzin dyes have been used in the same way for trypanomiasis, as well as some mild antiseptics. After death, these dyes introduced in the lumbar region have been found in the cerebral meninges, so that, if the foramen of Majendie is still patent, medicaments may be able to reach this important locality.

On these facts, medication, it would appear, may safely be initiated for cerebro-spinal fever in this way.

The question of when to inject presents some difficulties, but there is no doubt the earlier it is undertaken the more

meningitis. In the same way, we are not sure whether the meningococcus reaches the meninges by a direct route from the naso-pharynx, or whether the septicæmia that occurs is a preliminary to the blood infection of that tissue; though those fulminating cases, which apparently die more of toxæmia than anything else, point to this latter method.

Again, as to the problem of infection and the spread of the disease, the same facts are badly wanted. We want to know whether the virulence of the organism varies, and thereby causes merely a slight catarrh in one case and meningitis in another, or whether the tissues of the different patients are more responsible for the passage of the organism in the body by their own idiosyncrasy and variation, *e.g.*, of the prolongation of the sheath of the cranial nerves or of the construction of the ethmoidal sinuses, or, again, of the power of resistance of the anti-bodies in the blood.

The solution of these problems probably lies chiefly in the results of a large number of careful *post-mortem* examinations, in addition to the usual pathological inquiries during life. Again, the statement that a large percentage of contacts harbour the meningococcus in the naso-pharynx seems to require further corroboration now that some place these as low as 5 or 6 per cent. The discrepancy seems to some extent to be due to different methods of detection and recognition of the organism, but it is of importance, under these circumstances, to keep the mind open to other possible methods of transmission than is implied by the original view as to the large percentage accepted hitherto, more especially as it is not usual for a contact to contract the disease.

An unexplained fact in the ætiology of this disease is, that it is unusual for more than one case to occur in a house, although occasionally there may be as many as six from one domicile, in this way following the rule of scarlet fever and diphtheria. Where there is only one case, it would point to the idiosyncrasy of the victim, and where there are many, to the special virulence of the strain of meningococcus, perhaps, but we have proof of neither of these. In the first case, we are only likely to arrive at a solution by the careful investigation of the household and their previous movements, but a thorough investigation is seldom practicable. In the second case, Gordon's work (*J.R.A.M.C.*, Vol. 24,

THE INFLUENCE OF WAR ON DISEASE.

By SURGEON-GENERAL (TEMP.) H. D. ROLLESTON, M.D.,
F.R.C.P., R.N.

*Consultant Physician to the Royal Navy, Royal Naval Hospital, Haslar ;
Senior Physician, St. George's Hospital, etc.*

It is obvious that the altered conditions of life during war must influence the health of the Navy and Army. On the improvement of physique and health of recruits from towns, as the result of training in fresh air and sunshine, and on the practical absence of venereal disease in the isolated fleet, it is unnecessary to insist. But we must gratefully note that, as a result of the labours of those responsible for the sanitation of our defenders, the health of the Navy and of the Army has, with the exception of those in the Dardanelles, been remarkably good. The health of the regular Navy has indeed been much better than in peace time.

In the Grand Fleet, the percentage of men on the sick list is under 1 per cent., often only 0.6 per cent., and the figures would be even lower but for the higher percentage incidence among the men of the Royal Naval Reserve and the Royal Naval Volunteer Reserve. On two battleships with a complement of over 1,000 each, which I happened to visit on two successive days, there were two men only in the sick-bay. With the progress of this greatest of wars, evidence is gradually accumulating as to the modifications thus induced in medicine and surgery, and upon these it may be appropriate to offer a few general remarks, and then to refer specially to some of the morbid conditions which have been prominent since August, 1914.

GENERAL REMARKS.

War, by massing together in close quarters large numbers of men, and especially of young recruits, facilitates the spread of infection, and thus fevers which, in peace, are endemic or sporadic become epidemic; this has been the universal experience, and was shown in the case of typhoid fever in the South African War, of typhus in Serbia, and of paratyphoid

likelihood of success. This fact lands the practitioner into the position of having to act sometimes on purely clinical grounds, for it may happen that, even with the classical symptoms, such as stiff neck and Kernig's sign, the cerebro-spinal fluid may be clear almost up to the decease of the patient, when the meningococcus may at length be found. On the other hand, if the process is as safe as it appears, no harm should be done even in a mistaken diagnosis. Even in the absence of the organism and pus in the cerebro-spinal fluid, meningitis may often be demonstrated by the physiological changes in the cytology as well as in the sugar and albumen, and in Boveri's test; under these circumstances, an injection into the spinal canal would certainly be justified.

It has been said with some truth that cerebro-spinal fever is a disease of soldiers and babies, but it is not altogether easy to see why soldiers should be so much more attacked than other collections of young people. It would probably be profitable to study more closely the differences of their entourage and habits. The following points are perhaps worthy of mention:—

The age of the soldier may be taken as from 19–40, with a preponderance of the younger men, and, in the case of recruits, there are doubtless many younger than 19. This is the age most attacked. It is said that only seven per cent. of the cases are above 25.

While overcrowding is considered to be an important cause, it must be remembered that the life of the soldier, while being trained and prepared to be sent out, is a great deal in the open air, and that often the arrangements for the night and day are good, with good ventilation, and yet the disease spreads. The writer knows of a Government establishment, where there is a very large number of lads averaging about 16 years, and where all arrangements are admirable; yet the disease is in no way conquered, and always seems to linger there. From this, it would appear possible that the coccus had the opportunity of passing through many suitable naso-pharynges of the age it requires to become virulent, rather than that want of ventilation and crowding produced its ravages.

The seasonal incidence of the disease is another unsolved problem, but it is shared with so many other scourges that we seem to have no more chance of explaining it than in other cases.

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and, to a lesser extent, of cerebro-spinal fever among our own men during the present campaign. In war, the existence of healthy carriers of disease becomes a factor of great importance, especially in stationary conditions such as the trenches. Now that the hygienic arrangements of armies in the field have been so perfected, the carrier problem probably plays a much more prominent part than in the past. In France and Belgium, there was no explosive epidemic of enteric fever, such as would occur if the infection was water-borne, so that carriers appeared to be the cause of the outbreak (Leishman¹). The qualification implied by the word "probably" is, perhaps, necessary, for the existence of healthy carriers of disease has been generally recognized for a few years only.

By exposing large numbers of men to adverse conditions, the exigencies of war also lead to outbreaks of other morbid conditions which, in normal circumstances, occur sporadically or accidentally. This is seen in the so-called trench diseases—acute nephritis, the much-discussed nutritional change in the feet, gas gangrene, and tetanus (231, with a mortality of 57·7 per cent. (Bruce)), and "trench-fever"—some of which, however, are by no means confined to the trenches. The special form of acute lung disease—acute bronchitis and broncho-pneumonia—due to the employment of poisonous gases (chlorine, bromine) by the Germans, has, to the credit of nations, never been experienced in war before, but it is not absolutely unknown in peace as the result of accidents. The nervous strain of war would naturally be expected to produce much insanity, mental disturbance, and neurasthenia. My impression is that, in the Navy at least, this anticipation has not been fully realized, and, in a recent paper giving the experience on board a battleship, Beaton² found that mental troubles of a really serious nature occurred in less than 1 per cent., and mild neurasthenic conditions in less than 4 per cent. Quite possibly this is due to the absence of alcoholism among the seamen, for, in the Fleet, the allowance of stimulant is only half a gill of rum daily, and special precautions are taken to prevent the men having more. The conditions in the Fleet during war necessarily interfere with ventilation at night, and a considerable increase in the amount of pulmonary tuberculosis might natur-

ally be expected. Here I cannot give figures, but my impression is that this is not the case. The men are carefully watched, and any suspected case of tuberculosis is at once removed from the ship. The effect of defeat and of captivity, even when not accompanied by privation, is to render soldiers more susceptible to disease. The great epidemic of typhus in Serbia appears to have begun among Austrian prisoners, though here the sanitary conditions, or rather their absence, probably played a prominent part.

War, by altering their circumstances, may cause disease among the non-combatants, even of an uninvaded country, in many ways—by deterioration in the quantity and quality of food, by mental strain and depression, and by altered occupation. To illustrate the last factor first, the large numbers of men and women working in war factories are exposed to new and, in some instances, injurious influences. Thus, as the result of exposure to the fumes of tetrachlor-ethane, which is used for painting the wings of aeroplanes (and, incidentally, for dry cleaning and the destruction of vermin in Army laundries), an outbreak of toxic jaundice of a new type among aeroplane workers has been described.³ In the siege of Paris, it was noted that exophthalmic goitre became more frequent, and it seemed to me that this was also true after the Boer War. Both in the Boer War and this campaign, isolated cases in combatants have come under my observation. It would also be interesting to know if there has been an increase in the incidence of diabetes.

The surgery of war differs from that of peace. In ordinary circumstances it is the surgeon who makes most of the wounds and takes every precaution that they shall be aseptic, whereas, in war, his main duty is to deal with wounds already infected. In war, the surgeon's work is largely, as it was in the rather distant past, concerned with remedying the results of external injury, and much less in combating the ravages of internal disease. Until the war, amputations were comparatively rare; since its onset, they have been too often necessary. The prevalence of infected wounds is creating a literature of its own, which deals with the methods of antiseptics, or, in other words, shows that war surgery is antiseptic or "back to Lister," as Sir Rickman Godlee entitled his lecture at the Royal Institution, in contra-

distinction to the aseptic surgery of peace. With this has followed the discussion of new antiseptic applications—"borsal," hypochlorite of sodium ("Eusol" and "Eupad")—and of Wright's physiological drainage. The frequency with which shell and bullet wounds pick out parts of the body which are comparatively seldom selected by uncomplicated disease, is leading to the accumulation of special knowledge, which is facilitated by the assistance of the Medical Research Committee of the National Health Insurance. Thus, Gordon Holmes and Sargent have analysed their cases of injury to the longitudinal sinus in the skull, and discussions have been held on gunshot wounds of the head and of the peripheral nerves. The remarkable effects of shell shock, without gross lesion of the spinal cord, attracted attention early in the war (Elliott, Aldren Turner). Gordon Holmes gave the Goulstonian Lectures on spinal injuries of warfare, and "the functional neuroses caused by shell fire without visible sign of injury" is the subject for a special discussion at the Neurological Section of the Royal Society of Medicine. Arterio-venous aneurysm and hæmothorax are almost curiosities in peace, but are comparatively common in war.

It is interesting to compare the present war with that in South Africa. There is a marked contrast between the conditions on the Western line in France and Belgium, where, thanks to the admirable hygienic arrangements of the R.A.M.C. and the prophylactic anti-typhoid inoculation, the incidence of typhoid fever was insignificant in comparison with the casualties directly due to bullets and shells, and those in South Africa, where typhoid fever was endemic. But, as will be shown later, paratyphoid fever, against which there was little protective inoculation, has usurped the place ordinarily taken in war by typhoid. Wounds in France and Belgium become severely infected from the state of the soil, and gas gangrene and tetanus have been prominent; on the other hand, the conditions, as regards wounds, were remarkably favourable on the sunburnt veld of South Africa, where the antiseptic system, on a large scale, was employed for the first time in civilized warfare, but where, as the late Mr. Clinton Dent epigrammatically remarked, "the climate did more than the carbolic acid."⁴ Veld sores, however, which were probably due to coccal infection, were

common in the Boer War, and have not, so far as I know, their equivalent in Flanders. In the Dardanelles campaign, however, as has always been the experience in war until quite recently, disease due to infection through the alimentary canal—typhoid, paratyphoid, dysentery, diarrhoea, and jaundice—assumed grave proportions. Up to October, 1915, there were 78,200 medical invalidings from the Gallipoli peninsula, and diarrhoea was, as in South Africa, extremely common after landing. In South Africa, acute nephritis was very rare and “rheumatism” common, whereas in France the reverse holds good.

Enteric Fever.—In the nomenclature of disease, it is convenient to use “Enteric Fever” as a general clinical heading, and to include under it typhoid and paratyphoid fever A. and B. In this country, paratyphoid B. is the form met with, whereas paratyphoid A. is that seen in India, where the disease has been extensively studied by the medical staff of our Army. In 1912, Boycott estimated that three per cent. of the cases in this country regarded as typhoid were really paratyphoid B. As enteric fever has, of late years, become comparatively rare in this country, the existence of paratyphoid fever has not been much to the fore. The war, however, has changed this, and, both in Flanders and in the Dardanelles paratyphoid has been common. In France, both forms occur, the paratyphoid A. being probably introduced by our Indian contingent. We are indebted to Torrens and Whittington, H. Robinson, and Sir Bertrand Dawson, for analytical papers on the cases in France, and the number of men invalided from the Dardanelles, mainly with paratyphoid A. (Ledingham and Penfold), shows its frequency there.

In the Expeditionary Force on the Continent, as the result of anti-typhoid inoculation, paratyphoid fever is actually more frequent than typhoid. Thus, Sir Bertrand Dawson refers to 1,363 cases of enteric fever in France, of which 910, or 66·7 per cent., were due to paratyphoid infection. But mixed infections with *Bacillus typhosus* and paratyphoid bacilli may occur; I saw a case of this kind in England some years ago. As compared with typhoid fever, paratyphoid fever is less definite and less severe; cases are, therefore, more likely to remain latent or to be regarded as

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"influenza," and so to spread the infection. It is also much less fatal; among Sir Bertrand Dawson's 910 cases, the mortality was two per cent.; Torrens and Whittington give the mortality of paratyphoid B. as a little over four per cent., and, of paratyphoid A., as under one per cent. A different estimate, however, is given in the *British Medical Journal* (1915, II., 610) as to the relative fatality of the two forms of paratyphoid fever, viz., among 368 cases of paratyphoid A., 9 deaths, or 2.4 per cent., and among 447 cases of paratyphoid B., no deaths. The two forms are so much alike that their differentiation must depend on bacteriological examination. While agreeing with this, Torrens and Whittington state that paratyphoid A. is more prone to relapse, is milder, and lasts three or four days longer than paratyphoid B. (10-18 days). From the experience of this war, it appears that intestinal lesions in paratyphoid fever are more important than was formerly believed.

The value of Sir Almroth Wright's anti-typhoid inoculation has been fully confirmed. But there is a risk that statistics compiled of all the cases of "enteric fever" may show that a considerable number of men inoculated against *B. typhosus* have gone sick of what is termed typhoid or enteric fever, but is really paratyphoid fever. Every effort is now being made to avoid this fallacy, which might throw doubt on the efficacy of anti-typhoid vaccination, and give the anti-vivisectionists cause to blaspheme. As a rule, the anti-enteric vaccination has been with a vaccine of *B. typhosus* only, though Dreyer and Ainley Walker, at Oxford, have used a triple vaccine of *B. typhosus* and *B. paratyphosus* A. and B., which had been previously employed by Castellani and by Vincent who called it, for short, T. A. B. Castellani and Mendelson⁵ have described a tetra-vaccine of typhoid, paratyphoid A. and B., and cholera, with which 170,000 Serbians have been inoculated without any untoward results. It is obvious that an inoculation with a polyvalent anti-enteric vaccine, such as has been recently employed in the Royal Navy by Fleet-Surgeon Bassett-Smith, R N., is highly desirable.

Large numbers of convalescent enteric patients are now arriving in this country, and bacteriologists are very hard at work in examining their excreta so as to prevent the escape

of carriers into the general population. It is satisfactory to learn that, by the tenth week of convalescence, not more than one per cent. of patients are still carriers of the typhoid or paratyphoid bacilli.⁶ Further, during and after the South African War, when 31,000 convalescent enterics were invalided home, there was not any epidemic outbreak of enteric fever in this country, although precautions against the carrier state were not taken. Although it would be criminal to encourage the slightest relaxation of the regulations now in force to prevent the escape of carriers into civil life, the above considerations may serve to allay any excessive anxiety as to the occurrence of typhoid and paratyphoid outbreaks in this country.

Dysentery.—The prophecy that this "war disease" would break out on the Western front has, happily, proved false. But in the Dardanelles there has been a very heavy toll among our men. Diarrhoea was extremely common among the men when first landed in Gallipoli, and came to be expected as all in the day's work. In many cases, after a time, it passed into or was succeeded by dysentery, and then, for the first time, the men reported sick. The nature of the dysentery in the Dardanelles is an interesting question; when the patients arrive here—and fortunately the majority have become convalescent on the voyage—there has been little evidence that the disease is amœbic; whereas in the hospitals near the Dardanelles, especially in Alexandria and Cairo, the *Entamœba histolytica* is found in a large majority of the cases, and emetine is given hypodermically with gratifying success. As emetine destroys the entamœba, this may help to explain our failure to find it in the fæces. As Strong showed in the Philippines, the two forms of dysentery may occur side by side, and mixed infections are found. Difficulties also arise in the clinical diagnosis between dysentery and enteric fever. A patient clinically the subject of dysentery may be proved bacteriologically to be suffering from enteric, and *vice versa*; and it has been stated that every case labelled dysentery from the East should be regarded as potential paratyphoid fever (Bassett-Smith); out of 70 cases arriving at Plymouth as dysentery, 40 per cent. were paratyphoid A., 20 per cent. paratyphoid B., and 11 per cent. typhoid (Whiteside). Without bacteriological assistance, a

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Mediterranean, and a large number have been invalided to England. It may follow the diarrhœa which is so prevalent there, dysentery, typhoid and paratyphoid fever. I have seen it occur in the Royal Naval Hospital, Haslar, in a typhoid carrier, and at the Osborne Convalescent Hospital for Officers after dysentery, thus suggesting that, in both instances, the infection was brought from Gallipoli and remained latent. Dr. McBean Ross writes to me from the Mediterranean Expeditionary Force that, contrary to expectation, it is rarely the sequel of diarrhœa, and far less of definite dysentery, and that it is usually mild and without much constitutional disturbance. Patients seen on their return home, however, have usually lost much weight. The only necropsy that I have seen showed severe gastro-enteritis with a plug of tenacious mucus in the orifice of the biliary papilla. It is tempting to assume that this epidemic jaundice is the same as that long known in Egypt, and is infective in origin (*Bacillus proteus*).

Cerebro-spinal Fever.—Although it has been stated that it is not a war disease (Heiman and Feldstein), cerebro-spinal fever has, since the outbreak of war, for the first time in this country, as pointed out by Sir William Osler, prevailed in epidemic form. There were, in the first year of the war, over 400 deaths in the home Army, which placed the disease second on the list of the causes of death from acute infections, and 170 cases, with 90 deaths, in the Royal Navy. During 1913, the total force of the Navy was 126,830 men, and there were eight cases of the disease. The epidemic can hardly be explained, except as due to the massing of large numbers of young recruits among whom carriers existed, and the prophylaxis is, therefore, directed to improving the conditions of the recruits and combating the carrier state. The last is a difficult proposition, for carriers may be periodic or intermittent, alternately giving positive and negative results. For this reason, it would be wise to invalid out of the Services those who have recovered from the disease. Diagnosis, sometimes very easy, may be extremely difficult, and, without bacteriological assistance, meningismus, especially at the onset of pneumonia, may at first be indistinguishable. Other forms of meningitis, such as the pneumococcal variety, occurred during the epidemic. The onset of this disease may be extremely like that of influenza, and, conversely, influenzal

case of dysentery with fever may easily be regarded as enteric. It is hardly necessary to point out that a positive agglutination reaction for typhoid fever occurs in those who have been inoculated against that disease, and that, if such a patient has dysentery, reliance must be placed on bacteriological examination of the stools and not on Widal's reaction. The two diseases may be contracted at the same time, the symptoms of dysentery appearing first, and being followed by those of enteric, as I saw in South Africa; or dysentery may be a secondary infection of typhoid or paratyphoid fever.

In the treatment of the cases of dysentery arriving in this country, I have seen and tried various methods. In a few cases I have given antidysenteric serum, which has been stated to be one of the most successful serums, both hypodermically and per rectum; but probably this was not a fair test, for the men were old and the disease very severe. Sublimed sulphur (grs. v. to x.), combined with Dover's powder to prevent excessive purging, three to six times daily, as given by Richmond in South Africa, was very effective in some cases—those of a comparatively mild type—but was by no means constantly successful. Bismuth and charcoal in large doses have been tried, as have kino and salol. I have knowledge of cases which have improved after hypodermic injections of emetine, although they were not amoebic dysentery. Magnesium sulphate or sodium sulphate and washing out the bowel are probably inferior to appendicostomy, but I have not seen this operation performed during the war. For very frequent motions with tenesmus, morphine suppositories may be given. During convalescence, when constipation becomes troublesome, paraffin has appeared useful. The important question of diet I need hardly discuss; but one point as to prophylaxis is worth consideration, namely, that carriers of dysentery bacilli should logically be treated with the same stringent care as carriers of typhoid and paratyphoid bacilli. What has been said about the chances of typhoidal outbreaks after the war probably holds good, in the main, as regards dysentery; but Carver⁷ refers to some instances, both after the South African War and at the present time, of dysentery in this country probably imported from abroad, and urges that it should be a notifiable disease.

Jaundice has been very frequent among our troops in the

the hæmothorax is often so large that it cannot be left alone. Eighty-nine cases of sterile hæmothorax were tapped, and usually three pints of blood removed; in one case only did an empyema follow. From post-mortem examinations of 69 cases of hæmothorax, it appears that the effused blood always clots rapidly. It is advised that a sterile hæmothorax, except when small, should be aspirated; and it is pointed out that signs of air as well as of blood may be due to anærobic infection, and that immediate resection is then required.

Acute Nephritis.—Some time ago, "a new disease" was rather tentatively described; but it appears to be a true acute nephritis of unknown origin, of which, according to Langdon Brown,⁹ there have been 1,062 cases in our Army in France, up to the end of June, the numbers increasing as the months got warmer. Possibly the tonsils are the entrance of the virus which is not bacterial, though a filter-passer cannot be eliminated. The urine and blood are sterile. The main clinical features are œdema, albuminuria, casts, frequently hæmaturia, shortness of breath at the onset, variability in the duration, the tendency to remission and relapse, and ultimately favourable prognosis. Of Brown's 58 cases, one proved fatal, and of Abercrombie's 95 cases, none.¹⁰

The so-called *Trench Fever*, an intermittent fever of as yet unknown origin,¹¹ may apparently be confused with influenza, paratyphoid fever, and dengue, but differs from them clinically and bacteriologically. Doubtless there are still several fevers of unknown origin, and it has been suggested that trench fever may be due to the bites of body parasites, and thus might be compared to rat-bite and sandfly (or phlebotomus) fevers.

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meningismus may imitate cerebro-spinal fever. The general mortality has been high—over 50 per cent.—and the results of the intrathecal injection of anti-meningococcal serum have generally been disappointing. Much of the serum employed in this country has been found to be inert and unsatisfactory, possibly because, from the sudden demand for it, large quantities came from America, where few horses had previously been immunized, and were therefore bled too frequently. Dr. Robb, who provided this explanation, stated that a serum, even better than the original one, is now being prepared; and Sir Arthur May, Director General of the Medical Department of the Admiralty, informs me that Dr. Simon Flexner is very kindly providing for use in the Royal Navy a serum, specially prepared under his supervision at the Rockefeller Institute.

Hæmothorax in civil practice is rare, and, when it does occur, is usually the result of some rapidly fatal lesion such as rupture of an aneurysm or very severe trauma; therefore previous experience is of little value for the frequent cases seen in war. In the Boer War, the cases were remarkable for the presence of unexplained fever, which suggested an empyema and therefore invited exploration. Makins, however, found that suppuration did not occur unless the cases were explored or operated upon. Acting on this experience, I have watched the cases at Haslar, and only advised exploration when a considerable leucocytosis was associated with a spiky temperature. There certainly were a few empyemas, but the majority of the patients have improved, though very slowly. In some cases of left-sided hæmothorax, there was a persistently rapid pulse. In the Army, the conclusions and treatment have been very different. Rose Bradford and Elliott,⁸ on analysis of 450 cases of hæmothorax, find that 25 per cent. of the cases become infected, and that 10 per cent. prove fatal. Sepsis is responsible for 70 per cent. of the deaths; simple hæmorrhage, which is not likely to prove fatal after the third day, for five per cent., and the various complications for the remainder. Infection of a hæmothorax may occur as acutely as in infective peritonitis, and is prone to result, at the time of the wound, from fouling of the skin and clothing with earth and faecal bacteria. High-velocity bullets at short range and tearing fragments of shells produce much greater laceration than was seen in South Africa, and

must look to these as one of the causes of venous stasis. Puttees may be put on loosely, but the soldier, with his inexperience of bandaging, is inclined to put them on fairly closely; when puttees become soaked, they shrink by about one-tenth of their total length, and, in consequence, the constriction of the leg is increased.

In the trench warfare that has existed, the troops may remain standing or sitting for hours together with the feet and ankles, or even the legs, immersed in water without any chance of muscular exercise in the lower extremities to assist the venous circulation. In addition to this interference with the whole circulation in the feet, the lowered temperature, even above freezing point, causes a slowing in the capillary circulation in the superficial tissues as well as capillary contraction. In consequence, there is some exudation from the blood-vessels and œdema of the foot, which, encased in an unyielding boot, increases the pressure and still further impedes the circulation. The prolonged standing in the trenches and inactivity of the muscles, which ordinarily assist the venous circulation, still further burden the circulatory stasis in the feet. Probably not one factor alone, but the combination of several, enters into the causation of trench-foot.

SYMPTOMS.

The first symptom noticed by the patient is a feeling of numbness in the feet, so that he feels as if he is standing on his heels. This is accompanied or rapidly followed by marked pain in the foot, often described as "bursting," and when the boots are removed, there is found to be swelling of the foot and often discoloration of the skin.

General appearance.—The appearance of the feet may differ widely. The skin may be pale in colour, shining and scaly, slightly stretched or inelastic, or may be purple or mottled. There is usually swelling of the dorsum of the foot and toes, and there may be blisters containing clear or blood-stained fluid. The skin over the prominences of the toes may be dry, hard, and shrivelled, or, in some cases, black from superficial localized gangrene. Ulceration may occur from the blisters or from the separation of cutaneous gangrenous areas having a granulating surface, which is slow in healing. In more severe cases, gangrene may affect the toes or anterior part of the metatarsal area, the peripheral portions becoming blackened and dried in a transverse line across the foot,

TRENCH-FOOT OR SO-CALLED "FROST-BITE."

By R. H. JOCELYN SWAN, M.S., F.R.C.S.

Senior Surgeon, Royal Herbert Military Hospital, Woolwich, and Surgeon, Cancer Hospital, S.W.

ONE of the most important factors causing incapacity for service amongst our troops, during last winter's campaign in Flanders, was so-called "frost-bite," and it is to be hoped that the prophylactic measures adopted by the Army Medical Service may prevent the recurrence of the trouble this year. Still, some cases are almost certain to occur—several were seen by the writer during the first weeks of November—so that the following notes of the disease may prove useful.

Name.—The term "frost-bite" is perhaps unfortunate, for the disease bears little relation to that seen in the extremities during severe frost; in fact, the disease was most prevalent in troops who had not been subjected to a temperature below freezing point. Further, with few exceptions, the injury occurred in the feet, and only very rarely in the hands, the nose, and the ears. In addition, it occurred practically only in those soldiers who had to remain for long periods in the trenches, and so, perhaps, the name "trench-foot" is the more suitable for the affection.

Causative Factors.—In seeking for the prime causative factor in a long series of cases, one is impressed at once by the fact that the patients were almost invariably standing for many hours in water, thin mud, or in slush, and, in consequence, the ankles and feet were constantly wet. The lowered temperature not necessarily to freezing-point, probably plays an important part in diminishing the vitality of the tissues. More important, in my opinion, are factors causing immobility of the lower extremities, and any factor causing constriction to the venous return of blood from the feet. In answer to numerous inquiries, it was found that the soldier on active service usually wears boots of a larger size than that he is accustomed to wear at home, but in very few cases could I obtain an admission of his wearing more than one pair of socks. However, there may be some constriction from the tying of bootlaces and of the puttees, and I am sure we

dition present. In all cases, the object should be to prevent pain and to secure sleep, and, in many cases, aspirin, chloretone and chloral were given. Even the milder cases, in which perhaps only the toes are anæsthetic, should be kept in bed, the feet well powdered with a mixture of starch and boric acid, and covered by a thin layer of cotton wool. The feet should be raised by means of a pillow, which was found much more comfortable than a sling, and by which means the œdema is diminished. I found warmth, by means of hot bottles placed near the feet, often increased the pain, great care being taken not to let the bottle touch the feet, owing to the liability of causing burns in the anæsthetic areas. On the other hand, it was more frequently found that a cool temperature relieved the pain more than warmth, and I was in the habit of covering the feet with a light layer of wool or by bed-socks and leaving them exposed, slightly raised on a pillow at the end of the bed.

When the pain and tenderness are rendered less acute by rest, etc., much good may follow from massage and passive movements. At first, the massage must be very light, owing to the deep-seated tenderness, but, later, firmer rubbing may be employed, and the patient encouraged to move the toes and various joints frequently during the day, followed by walking exercises as the pain diminishes. Various oils, such as eucalyptus oil, alone or mixed with castor oil, were employed with the massage, and appeared to do good.

When the skin is broken by blistering, or small areas of blackened skin are present, the area should be carefully cleaned and dried, then painted with a two per cent. solution of iodine and spirit and covered with cyanide gauze. In cases in which dry gangrene was present, either as an area on the inner aspect of the great toe or as a more extensive dry gangrene of several toes which become blackened and shrivelled, I consider it best to keep the foot cleaned and await the formation of a clear line of demarcation and gradual separation of the gangrenous portion, rather than to attempt any formal amputation through tissues already in a low state of vitality. In this way it may be necessary later to trim away any projecting piece of bone, but the ultimate result is more satisfactory, in that much less tissue of the foot is sacrificed than if amputation is performed and flaps

usually involving the inner side of the foot more than the outer, whilst later a distinct line of demarcation will form. Rarely, a massive moist gangrene occurs accompanied by superficial necrosis of the skin, rapidly spreading sepsis in the tendon sheaths and tarsal joints, with pyrexia and free, foul, purulent discharge from the surface.

Nervous changes.—The sensation was found to be affected in all cases of trench-foot. In many cases, there was cutaneous anæsthesia of the toes and dorsum of the foot, of the stocking form rather than following the distribution of any particular nerve. In others, there was marked hyperæsthesia of the skin of the distal part of the dorsum of the foot, the lightest touch even of a camel-hair brush causing marked pain. In some cases, an area of anæsthesia would be outlined by a band of hyperæsthesia, but I was unable to find any case in which I could say that an area previously anæsthetic became hyperæsthetic. In cases showing either cutaneous hyperæsthesia or anæsthesia, it was common to find pain caused by pressure, as elicited by grasping the thickness of the foot between the finger and thumb. In the more severe cases, pain on pressure was felt over the muscles of the leg. I am convinced that these sensory changes are not due to a functional neurosis, as has been suggested, but are caused by tissue change, due to vasomotor constriction maintained for some time.

Motor changes.—As a rule, the toes could not be moved voluntarily or only with difficulty. Passive movement of the toes caused pain in the foot.

In one case under my care, a similar condition existed in the fingers of the left hand, and I found, on careful inquiry, that the patient had worn a woollen glove, which was constantly wet, on this hand, whereas the right, which had remained ungloved, was unaffected. In another case, in which a patient had remained wounded in the foot in a shell-hole for five nights and four days without food, both hands and feet were affected, and local dry gangrene occurred. In only one case did I find the nose and ears affected.

TREATMENT.

The treatment of trench-foot must be considered for the active condition and the preventive. In the active stage, the treatment will necessarily vary according to the actual con-

dition present. In all cases, the object should be to prevent pain and to secure sleep, and, in many cases, aspirin, chloretone and chloral were given. Even the milder cases, in which perhaps only the toes are anæsthetic, should be kept in bed, the feet well powdered with a mixture of starch and boric acid, and covered by a thin layer of cotton wool. The feet should be raised by means of a pillow, which was found much more comfortable than a sling, and by which means the œdema is diminished. I found warmth, by means of hot bottles placed near the feet, often increased the pain, great care being taken not to let the bottle touch the feet, owing to the liability of causing burns in the anæsthetic areas. On the other hand, it was more frequently found that a cool temperature relieved the pain more than warmth, and I was in the habit of covering the feet with a light layer of wool or by bed-socks and leaving them exposed, slightly raised on a pillow at the end of the bed.

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formed. In one case under the care of my colleague, Captain Cecil Rowntree, separation of the dry, gangrenous, anterior portion of the foot took place behind the heads of the metatarsal bones, and no operative interference was necessary.

Occasionally, the gangrenous portion is of the moist variety, with rapid tissue necrosis and rapidly-spreading suppuration in the tendon sheaths and the tarsal joints, with accompanying pyrexia. In these cases, amputation should be performed without loss of time, either through the ankle joint or the leg. I have only seen two cases of this advanced degree, in one of these both feet were affected, one being removed through the ankle joint, and the other through the lower third of the leg. The patient was profoundly septic, but made a good recovery, and I saw him recently walking with two artificial legs with hardly any perceptible difficulty. In another case, only one foot was affected, but the day after arriving in England, he developed tetanus, from which death resulted.

Preventive Treatment.—It is to the prevention of the condition that attention should be chiefly directed, and though we have been informed that measures have been adopted by the authorities to prevent trench-foot occurring, we have not, for obvious reasons, been told the actual precautions taken. It is sincerely to be hoped that the prophylactic measures will be efficient, and so save the very large number of incapacitated troops that occurred last year; but even during the first weeks of November, many cases occurred, and I was unable to obtain from them any evidence of any precautionary measure being adopted. These men had been standing with feet immersed in water in the trenches for four or five days together, and presented exactly the same symptoms as the cases received last year. To my mind, the condition of trench-foot is due to the prolonged maintenance of a pendant position of the feet, wet from soakage in the slush and mud in the trenches, without any opportunity of movement or of drying the feet, rather than to the severity of frost. Prevention should take the form of—

- (1) drainage of the trenches or the use of raised wooden platforms on which to stand, and
- (2) the measures directed towards keeping the feet dry,

and eliminating any cause of venous stasis in the extremities.

Drainage of the trenches is obviously out of place in a medical paper, and equally obviously difficult in the changing centres of activity, but measures under heading (2) should be encouraged. In the first place, any factor causing even slight constriction to the leg or foot must carefully be avoided. Thus, the boots should be at least two sizes too large, the bootlaces should be loose, and puttees must be very lightly rolled, for both boots and puttees shrink with the wet. However, neither the ordinary regulation boot nor the puttee will prevent the feet getting wet when standing in water; the rubber gum-boot would do so, but it would necessarily impede movements both in attack and defence, whereas waders, as used by fishermen, are too expensive for general service.

Some ten months ago, when discussing this subject, I put forward the suggestion that a thin loose mackintosh stocking should be provided to be worn over the sock and under the puttee. This would not only be watertight, but would provide for a thin layer of air between the skin and the sodden exterior, and thus form an excellent insulating medium. It is true that body moisture would be retained, but at the same time so would warmth—an essential condition in these cases. Another means of prevention, which was used extensively in the later months of 1914, was the liberal use of vaseline or whale oil smeared over the feet, but I think that where men are fighting in water-logged trenches some means of more frequent relief might be adopted, so that the feet may be dried, socks changed, and exercise allowed to restore the normal circulation in the feet; whilst, with the large boots allowing room for movements of the toes, the men should be instructed and encouraged in every way possible to practise muscular contractions of the toes and muscles of the leg, even whilst standing still, to improve the circulation in the feet. Doubtless, these and other points have been thoroughly considered by the authorities, and it is sincerely to be hoped that the organized measures adopted may be successful in preventing the occurrence amongst our troops of such a painful trouble as trench-foot, which deprived us last year of the services of many thousands of otherwise able fighting men.

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The medical profession has not taken the trouble to investigate the nature of the treatment, and has regarded its use as purely empirical. Many patients, and even some medical men, think that a patient comes away from his electrical treatment highly charged with a mysterious force called electricity, which produces in his system some weird changes surpassing all human understanding. This, of course, is arrant nonsense; we do not administer so many milliamperes or amperes of electricity in the manner we prescribe so many drachms or ounces of a drug. Electricity merely supplies us with energy or force, from which, by suitable instrumentation, we obtain the therapeutic energy we require, such as thermal energy in diathermy, mechanical energy in ergotherapy and the Morton wave current of the static machine, chemical or electrolytic energy in ionic medication and galvanism, actinic energy for light treatment, radio-energy for X-ray diagnosis and treatment.

When we realize its mode of action, electrical treatment ceases to be empirical, and we are able to visualize, so far as our pathological knowledge permits, the steps by which the relief of symptoms is produced, or a cure of the disease is effected.

The soldiers suffering from trench-feet usually arrive in hospital in England about a fortnight after the onset of the trouble, and the symptom which then most demands attention is the pain in the feet, often most intense and agonizing in character. There is no remedy which affords more immediate or more lasting relief to the pain than diathermy.

Diathermy is a form of high frequency current of very large amperage and of moderately high voltage or potential. In the older forms of high frequency current, the potential is many thousand volts, but the amperage or amount of current which passes is small. In diathermy, the voltage is only about 800, but the amount of current passed through the tissues frequently reaches two or three amperes, which is more than sufficient to light four 16-c.p. lamps on a 100-volt circuit. The direction of the current is changed about a million times a second, and upon the frequency of this oscillation the safety of the treatment depends. The only effect noticed is the heat produced in the tissues by friction of the electrons, oscillating backwards and forwards in the

THE ELECTRICAL TREATMENT OF TRENCH-FOOT AND FROST-BITE.

By W. J. TURRELL, M.A., M.D., CAPTAIN R.A.M.C. (T.F.).

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Infirmary, Oxford.*

THE stasis and congestion in the tissues of the feet, produced by the injury to the walls of the blood-vessels as the result of prolonged exposure to cold, is the condition which primarily calls for treatment in cases of trench-foot. If we remove this stasis and congestion, we shall thereby relieve the swelling, the pain, the numbness, the tingling, and the other symptoms which are the result of this pathological condition.

Many interesting methods of treatment have been advocated in the medical journals during the past year. Wrapping the feet in cotton wool was by some considered to be the only treatment required, whilst others advocated the exposure of the feet without any covering at all. Some adopted rest, and the expectant method, whereas others regarded massage and exercises, such as sliding the feet up and down the walls and bed-posts, as the ideal methods; by some, the application of heat was thought desirable, others preferred the application of cold. Many drugs have been recommended, but only those for the relief of pain, such as morphine or aspirin, were adopted with general success. The simplicity and the contradictory nature of the remedies recommended lead one to doubt their efficiency.

Fortunately, modern electro-therapeutic measures supply us with the means of removing this condition of congestion and stasis, of inducing repair of the tissues that are not past recovery, of relieving the acute pain and the other distressing symptoms which may supervene.

Until recently, and, perhaps, even to-day it is the case, the benefits to be obtained from electrical treatment have been obscured by a cloud of professional suspicion, which has arisen from the practice of electrotherapy by unqualified, ignorant, and untrained so-called medical electricians.

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was about 20° C. The result was a marked increase in the œdematous swelling and a considerable amount of hæmorrhagic infiltration. From this it becomes evident that during the period of recovery, attention must be concentrated on preventing any strain on the damaged blood-vessels. Anything which causes congestion, will have a tendency to increase the injury to the vessels' walls, already damaged by exposure to cold." (Profs. Lorrain Smith and Ritchie, and Dr. Dawson: "Trench Frost-bite." *Lancet*, September 11th, 1915.)

Very rarely, one may find that the first application of diathermy slightly increases the pain; in these cases, the second application almost invariably gives some relief. On the other hand, although the application of radiant heat from a 50-c.p. carbon filament lamp usually gives relief in the slighter cases of frost-bite, nevertheless, it frequently aggravates the pain.

The marked relief from pain following the application of diathermy, is due to the relaxation of spasm, and the reduction of tension and pressure, which follows the production of heat in the tissues.

The following cases of trench-foot are quoted to show the effect of diathermy in relieving pain:—

CASE 1.—Private G. S. December 17th, 1914.—Patient was frost-bitten about the end of November, whilst in the trenches in France. He stayed in the trenches till December 11th, when he was unable to endure the pain any longer and reported sick. The pain continued every night, disturbing his sleep. December 18th.—Considerable pain last night. December 19th.—Diathermy 10 by 5 c.m. electrodes, 0.9 amp. 10 minutes, administered yesterday. No pain since treatment; a good night. December 20th.—Diathermy repeated on the 19th. There is now no pain in the feet. Patient can walk well, and is fit for sick furlough.

CASE 2.—Private J. D. December 31st, 1914.—Patient reported sick with frost-bite on December 16th. Pain only at night. Slight discoloration. January 2nd, 1915.—Patient complains that his toes "go dead cold" in the night, and that he cannot sleep in consequence. Recommended for electrical treatment. January 6th, 1915.—Patient felt great benefit from the treatment. It was not repeated yesterday, and the feet felt very cold again last night. Electrical treatment to be resumed. January 7th, 1915.—Patient had diathermy again yesterday, and had the first good night which he has had for three weeks. Has the "sense" in his big toes this morning. "No pain whatsoever; in fact, I feel nothing. Ready

area between the pads of application.

An electrode is placed on either side of the part to be treated, the current passes in a straight line from one electrode to the other, and its direction is in no way influenced by the conductivity of the neighbouring structures. The amount of heat generated in the tissues is directly proportional to their electrical resistance. The skin offers the greatest resistance to the passage of the current; it therefore heats most, and thus acts as a safeguard against overheating the underlying structures. The sensation of the patient is the most important guide to the strength of the current to be used, and, therefore, when sensation is lost, which is sometimes the case in trench-foot, diathermy must be administered with the greatest care, and only a small amount of current used.

The importance of diathermy is that it will produce any required degree of heat in any structure or organ of the body. There is no need here to expatiate on the effects of heat; its therapeutic value has been recognized from the earliest times, and very many different methods have been devised for its production and application. But, nevertheless, until the discovery of diathermy, the methods of applying heat were haphazard and incomplete. Now, however, by means of diathermy, we can heat the heart, and relieve the crises of angina; the lungs, and abort an attack of asthma; the ovaries, and give immediate and lasting relief in the most acute cases of dysmenorrhœa; the ureter, and relieve its spasm, and thereby facilitate the passage of a renal calculus.

Apart from the production of heat, tissue drainage is increased by the oscillations of the current, as may be seen by the decrease in the swelling, which immediately follows the application of diathermy to a badly-sprained ankle. A marked decrease in the swelling of frost-bitten feet is also seen after the application of this treatment. This point is of importance, in view of some recent observations based on experiments on animals in reference to trench foot.

"Finally, the harmful effect of raising the temperature of the feet damaged by cold was clearly demonstrated. The animal's feet were placed in water which was, at the beginning of the time, at 37° C., and cooled down gradually till it

was about 20° C. The result was a marked increase in the oedematous swelling and a considerable amount of hæmorrhagic infiltration. From this it becomes evident that during the period of recovery, attention must be concentrated on preventing any strain on the damaged blood-vessels. Anything which causes congestion, will have a tendency to increase the injury to the vessels' walls, already damaged by exposure to cold." (Profs. Lorrain Smith and Ritchie, and Dr. Dawson: "Trench Frost-bite." *Lancet*, September 11th, 1915.)

Very rarely, one may find that the first application of diathermy slightly increases the pain; in these cases, the second application almost invariably gives some relief. On the other hand, although the application of radiant heat from a 50-c.p. carbon filament lamp usually gives relief in the slighter cases of frost-bite, nevertheless, it frequently aggravates the pain.

The marked relief from pain following the application of diathermy, is due to the relaxation of spasm, and the reduction of tension and pressure, which follows the production of heat in the tissues.

The following cases of trench-foot are quoted to show the effect of diathermy in relieving pain :—

CASE 1.—Private G. S. December 17th, 1914.—Patient was frost-bitten about the end of November, whilst in the trenches in France. He stayed in the trenches till December 11th, when he was unable to endure the pain any longer and reported sick. The pain continued every night, disturbing his sleep. December 18th.—Considerable pain last night. December 19th.—Diathermy 10 by 5 c.m. electrodes, 0.9 amp. 10 minutes, administered yesterday. No pain since treatment; a good night. December 20th.—Diathermy repeated on the 19th. There is now no pain in the feet. Patient can walk well, and is fit for sick furlough.

CASE 2.—Private J. D. December 31st, 1914.—Patient reported sick with frost-bite on December 16th. Pain only at night. Slight discoloration. January 2nd, 1915.—Patient complains that his toes "go dead cold" in the night, and that he cannot sleep in consequence. Recommended for electrical treatment. January 6th, 1915.—Patient felt great benefit from the treatment. It was not repeated yesterday, and the feet felt very cold again last night. Electrical treatment to be resumed. January 7th, 1915.—Patient had diathermy again yesterday, and had the first good night which he has had for three weeks. Has the "sense" in his big toes this morning. "No pain whatsoever; in fact, I feel nothing. Ready

for a double." January 9th, 1915.—Patient has no pain; can walk well. Sick furlough.

CASE 3.—January 21st, 1915.—Lance-Corporal R. S. was frost-bitten in France, January 10th. There is some blackening of the skin on the plantar surfaces of the feet, and patient suffers a great deal of pain. January 25th, 1915.—Patient has been twice treated by diathermy. Both feet are better; still a little pain in the left foot. Had the best night since he has been sick. January 27th, 1915.—Treated by diathermy yesterday. No pain to-day, and no further electrical treatment is required. January 28th, 1915.—No pain in feet. February 4th, 1915.—The feet are well. Discharged to sick furlough.

The following is a late case, which was admitted on account of severe pain whilst he was on sick furlough after treatment for frost-bite in a London hospital:—

CASE 4.—January 29th, 1915.—Private T. N. Present condition: Pain and swelling in the left foot. Electrical treatment recommended. February 1st, 1915.—Patient feels better; he would "like another turn on that electric; it has taken all the swelling out; it has gone down to the toes." Still some swelling round the ankle. Patient was treated by diathermy on January 30th, 1915. February 2nd, 1915.—Feet a lot better; bad headache this morning. February 3rd, 1915.—Still some pain in left foot. February 4th, 1915.—Pain was very severe again last night; diathermy to be resumed. February 6th, 1915.—Much better to-day; slept well. February 8th, 1915.—No pain now; still limps a little in walking. February 9th, 1915.—Patient was again treated by diathermy and now walks without limping; discharged to sick furlough.

For the notes on the two following cases I am indebted to Captain C. A. Coventon:—

CASE 5.—The patient was admitted on December 31st, 1914. Frost-bite in both feet; very painful, preventing sleep. On January 1st he was sent to the Radcliffe Infirmary for electrical treatment (diathermy). On the 5th there was much less pain, he slept well, and there was more movement. On the 6th, the improvement had continued, and, as he was quite well, was discharged to sick furlough. The electrical treatment in this case seemed to cause immediate improvement, the pain ceased, and convalescence went on uninterruptedly.

CASE 6.—Frost-bite in both feet. The patient was admitted on December 31st, 1914, with great pain necessitating morphia; there was no discoloration and very little movement. On January 3rd, 1915, he was sent to the Radcliffe Infirmary for treatment by Captain Turrell. On the 5th, the pain was much less, he slept through the night, and had much more movement in his toes. On the 12th, he continued to improve. On the 14th, he was discharged to sick furlough. The remarks on the improvement of the other case equally apply to this one.

In treating cases in which there is considerable swelling, with numbness, ecchymosis, induration or ulceration, the static breeze current is the most effective remedy. The current in this case is unidirectional instead of oscillatory; it is of enormous voltage, but, as it never exceeds one or two milliamperes, it is absolutely safe. Probably no methods of electrical treatment are viewed with such distrust and suspicion as the static modalities. The spectacular character of the static discharge appears to have given origin to the erroneous impression that its action is merely by suggestion; but probably the static machine has chiefly fallen into disrepute because its mode of action has not been understood, and absolutely inefficient machines have been used. Nevertheless, it is very extraordinary that these views should be so generally held, because there is no form of treatment in which the beneficial effects and their mode of production can be demonstrated more clearly and more strikingly than in the Morton Wave treatment with the static machine.

For instance, a patient with synovial effusion in his knee-joint is seated on the insulated platform, a thin metal electrode is bandaged on his quadriceps extensor, and connected by a copper wire to the positive pole of a powerful static machine, such as one with eight stationary, and eight revolving plates of 36 inches diameter. The machine is so controlled that sparks pass across a gradually increasing spark-gap about 120 times a minute. During the interval between the sparks, the whole of the patient's body is charged with positive electricity at a pressure of several hundred thousand volts; at the moment the spark jumps the gap in the machine, the whole of the patient's charge suddenly discharges at the point of attachment of the electrode, producing a violent, but painless, contraction of the powerful thigh muscles. The force and power of these contractions are far greater than can be produced by any other method, and their vigour can be increased or diminished by regulation of the spark-gap. By this means, periods of vigorous contractions alternating with passive relaxation are excited in the muscles, and this form of what may be termed "auto-muscular massage" frequently leads to the total absorption of the fluid from the knee-joint at the end of twenty minutes' treatment.

Or again, for example, a patient with acute lumbago, who

suffers severe and sudden pain on the slightest movement of his lumbar muscles, may be painlessly treated with the Morton Wave current with a gradually increased spark-gap, and, at the end of twenty minutes' treatment, will be quite free from pain. The explanation of this result is that some fibres of his lumbar muscles are partially glued together by inflammatory exudation; the auto-muscular massage breaks down these adhesions, and induces the re-absorption of the inflammatory products. These results can only be obtained by the use of powerful machines.

The Morton Wave current is useful in the later stages of trench-feet to remove persistent swelling and stiffness; in the acute stages, its use is not indicated.

The static breeze current is the most useful of the static modalities in the treatment of trench-feet. The patient is placed on an insulated platform, and is connected with the negative pole of the machine, the spark-gaps being widely separated so that no spark passes between them. The patient thus remains charged with negative electricity at high voltage. If a good conductor, such as a grounded metal rod, is brought near the patient, he will suddenly and disruptively discharge with a painful spark; but, if an electrode of bad conducting quality, such as a wooden stick, is brought near the patient, he discharges steadily in the form of a breeze, which appears, owing to the dust particles in the air which it illuminates, as a bluish-purple flame. This breeze is applied to the part to be treated.

In trench-foot, the application of the static breeze is found to remove stasis and congestion, and hence it relieves pain, tingling, and numbness. It also excites an active hyperæmia which stimulates the recovery of the tissues, whose vitality has not been destroyed, and it accelerates the separation of the necrosed parts. The stimulating effect of this current on ulcerating and excoriated surfaces is very remarkable; the ozone, which is produced in considerable amount by the electrical discharge, probably plays an important part in producing this result.

In his book, *High Potential and High Frequency Currents*, Dr. Benham Snow thus describes the action of this treatment:—

“The effect upon local stasis . . . where swelling and induration are present is generally to

soften the tissues. This is due to the action of the discharges producing recurrent contractions of the tissues, thereby inducing an onward movement of the blood current through the vessels. Over superficial œdema . . . and where ecchymosis is present, the effect of these applications systematically applied is remarkable in its results . . . To ulcerated surfaces the application of these modalities is one of the most valuable in therapeutics. Applied over the indurated margin, where it has a positive effect in relieving stasis, it proves to be of the greatest value for the relief of those conditions. The circulation is restored throughout the zone of induration, which surrounds the ulcer, when a reparative process is immediately instituted."

Usually, diathermy relieves the pain of trench-foot more speedily and with greater certainty than the static breeze; one case, however, proved a notable exception to this rule. This patient suffered agonizing pain, and though for two days he derived little or no benefit from diathermy, he was immediately relieved by one application of the static breeze; he slept the whole of the following night, and a slight recurrence of pain on the following day was completely removed by a repetition of the treatment. There was no further relapse, and in two days the patient was walking about the ward.

The following interesting case was treated at the Radcliffe Infirmary for severe frost-bite resulting in necrosis of the toes. The chief point of interest in the case was the occurrence of acute boric poisoning during the treatment. It is the only case of trench-foot in which any untoward symptom has resulted from electrical treatment, and it is difficult to see in what way the static current can have contributed to the absorption of the poison. Probably the toxæmia was the result of an idiosyncrasy.

On admission to the hospital, the toes of this patient were hard, dry, and withered; a line of demarcation had already appeared about an inch from the base of the toes. The sole of the foot was covered by a large black bleb. Under the application of the static breeze the pain, which at first was severe, disappeared, and the bleb on the sole quickly dried up. At about the end of a month, the toes separated at the metatarso-phalangeal articulation, leaving a very healthy granulating surface of about 125 square centimetres; this was every day freely dusted with boracic powder. The patient, whose general

health had previously been particularly good, became listless and lost his appetite. A rash appeared, commencing as a few scattered papules; it soon developed into a seborrhoid type distributed all over the body, with a psoriasis appearance on the elbows. The scalp became very scurfy. Itching and irritation were only troublesome at the onset. On the second or third day, minute papules appeared on the interdigital clefts of the fingers, and the sister of the ward, mistaking them for scabies burrows, applied sulphur ointment. On the following day, the fingers were studded with sago-like nodules, especially thick at the bases of the nails; these nodules subsequently became confluent, forming blebs, clear at first, and then pustular. The face and eyelids became swollen and stiff, and difficulty was experienced in opening the mouth. The sight became dim. The pulse was very weak and frequent—132, with temperature 100° F. The tongue was swollen, inflamed and fissured. The patient's condition became very serious, and only liquid nourishment could be taken. Boron was present in the urine. The treatment consisted in the administration of alkalis with a view to the elimination of the boron as the soluble sodium borate. The patient ultimately made a very good recovery, and suffered no after-effects from the boric toxæmia. The foot was trimmed up, a useful stump resulted, and the patient walked so well that there was some hesitation in invaliding him as unfit for further military service.

In promoting the absorption of blebs, and in treating the ecchymosed surfaces of trench-feet, the high frequency vacuum tube is most useful. This, like diathermy, is an oscillating current, but its voltage is much higher and its amperage less. Its application tends to relieve pain, causes active hyperæmia, and excites tissue drainage in the superficial structures. Its action does not penetrate far into the tissues, and the vacuum tubes cannot be conveniently applied when the skin is broken.

Numbness will often persist in trench feet for many months, if not electrically treated. The best treatment for these old-standing cases is the continuous galvanic current; the following notes illustrate a case of this kind:—

Private H. S. Frost-bitten on December 31st, 1914. Admitted to hospital on January 1st, 1915. No electrical treatment. Sent to Convalescent Home, March 13th. Returned from Convalescent Home, May 27th, 1915, with view to an invaliding board as unfit for further military service. The following are the notes of the medical officer in charge of the case:—June 1st.—Referred to Captain Turrell for electrical treatment. July 2nd.—Has been attending at Radcliffe Infirmary every day. He soon felt his feet getting "warmer," has been distinctly improving, and now is getting sensation especially in left foot, and can walk much more securely. July 12th.—Steadily improving. July 24th.—Still improving, but has sore and blistered

toe, right. August 5th.—Has very much improved by the electrical treatment, and now has very fair sensation. Discharged sick furlough seven days, and then for light duty.

The results to be obtained by the electrical treatment of trench-foot and many other diseases, cannot be equalled by any other methods. Unfortunately, the very inadequate electrical equipment of most hospitals renders the benefits of electrotherapy unavailable. It is, moreover, not merely a question of instrumentation to obtain good results by electrical means, it is necessary for the electrotherapist to know not only the nature of the condition which he wishes to relieve, but also to have some knowledge of the means by which the desired results can be produced. The former entails some knowledge of pathology; the latter, far more easily acquired, some knowledge of electrical methods. The full benefits of electrotherapy will never be obtained, until its practice is removed from the hands of the ignorant and untrained and placed under the direct control and supervision of qualified medical men, who have made themselves acquainted with the main principles of electrical methods. Certainly, electrotherapy has made great progress during the past few years. But how slow and delayed this progress has been!

John Wesley, the eminent divine, writing more than a century and a-half ago, thus concludes his book, *The Desideratum: or Electricity Made Plain and Useful*, By a Lover of Mankind, and of Common Sense:—

“Before I conclude, I would beg one thing (if it be not too great a favour) from the gentlemen of the faculty, and indeed from all who desire health and freedom from pain, either for themselves or their neighbours. It is that none of them would condemn they know not what; that they would hear the cause before they pass sentence; that they would not peremptorily pronounce against electricity while they know little or nothing about it. Rather let every candid man take a little pains to understand the question before he determines it. Let him for two or three weeks (at least) try it himself in the above-named disorders. And then his own senses will show him whether it is a mere plaything or the noblest medicine yet known in the world.”

WAR INJURIES OF THE PERIPHERAL NERVES.

By HARRY CAMPBELL, M.D., F.R.C.P.

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THIS war is performing, on a vast and tragic scale, a series of physiological experiments on the brain, spinal cord, and peripheral nerves of man. As early as last spring, the French physician, Léri, was able to give a record of as many as 400 cases of peripheral nerve injury observed by him, and the German physician, Oppenheimer, had already seen 50 cases of injury to the sciatic nerve alone.

The constitution of nerve-trunks.—Most nerve-trunks contain three different sets of fibres—voluntary motor, sensory, and sympathetic (Fig. 1). The voluntary motor fibres are distributed to the voluntary muscles, the sensory fibres to

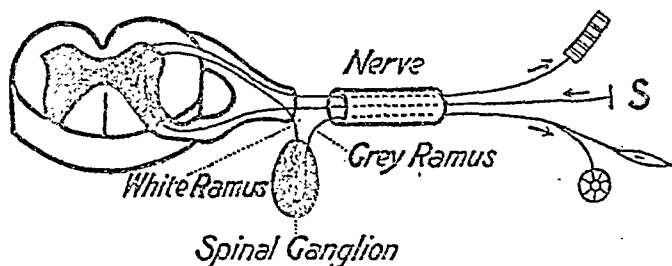


Fig. 1.—Diagram showing the constituents of a mixed spinal nerve. The voluntary motor nerve-fibre is seen arising from the ventral horn and passing through the ventral root. The sensory fibre (S) is seen entering the cord through the dorsal root. The sympathetic strand is seen to consist of a pre-ganglionic and a post-ganglionic portion, the former arising in the lateral horn and leaving the spinal cord by the ventral root.

the sensitive tissues (skin, muscles, bones, ligaments, etc.), while the sympathetic fibres supply the involuntary muscle-fibres (blood-vessels and hair-muscles), and the cutaneous glands.

The voluntary motor nerves exercise a trophic influence on the muscles they supply, and it is known that the nutrition of the other tissues is directly influenced through the medium of the nerves, but exactly through what fibres

we do not know—probably the sympathetic filaments running for the most part in sensory nerves. It is not known whether the limbs and body-wall are furnished with afferent sympathetic fibres.

We learn, then, from the constitution of nerves, that lesions of them may produce motor, sensory, vaso-motor, trophic, and secretory effects.

The orderly arrangement of fibres in nerve-trunks.—The nerve-fibres do not run indiscriminately within the nerve-trunks; they are arranged according to a definite plan. Indeed, a nerve-trunk may be regarded as being made up of a combination of the individual nerves which it gives off, so that it may be possible, if a portion only of a nerve-trunk is severed, for the effects to be limited to one of its branches. Thus, in a wound of the external portion of the sciatic, the muscles supplied by the external popliteal nerve are paralysed; while severance of the internal fibres causes paralysis of the muscles supplied by the internal popliteal. It is even possible for the sciatic nerve to be wounded in such a way that the anterior tibial branch of the external popliteal is alone paralysed. Again, in a wound of the median, the paralysis may be limited to the thenar muscles supplied by it, and Wilfred Harris has shown that those sensory fibres of this nerve which supply the dorsum of the hand run in the dorsal part of the nerve.

The definite arrangement of the fibres in a nerve-trunk can also be shown by Faradizing different parts of its circumference. In this way we can stimulate at will the following groups of fibres within the sciatic: fibres to (a) the tibio-peroneal muscles, (b) the gastrocnemius and soleus, and (c) the flexors of the toes. In the case of the median, we can, in a similar way, cause the separate contraction of: (a) the flexor carpi radialis, (b) the flexors of the fingers, (c) the pronators of the forearm, and (d) the thenar muscles innervated by the median.

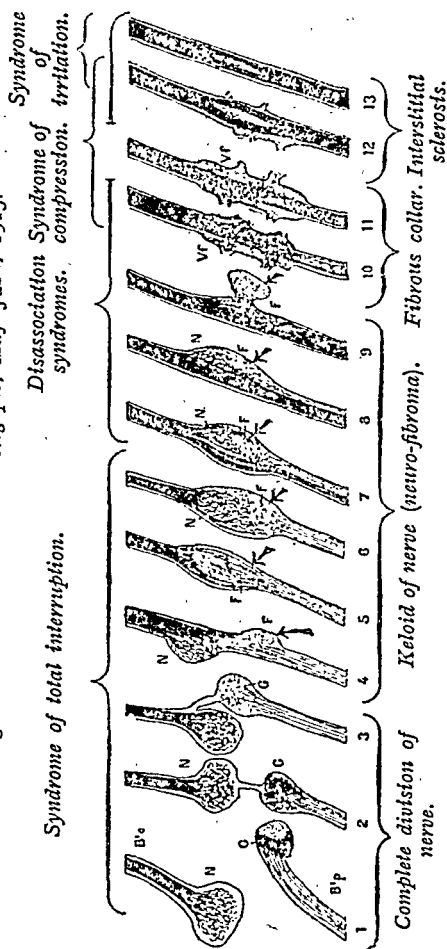
The practical lesson we learn from the knowledge of this orderly arrangement of the nerve-fibres is evident: in suturing a divided nerve, care should be taken to oppose, as far as possible, corresponding fasciculi in the two ends.

Changes in the nerve-trunk occurring secondarily to section, partial or complete.—When the nerve-fibre of a peripheral

nerve is severed, changes take place in the entire neuron to which it belongs. In the lower segment, the axis-cylinder and myeline sheath entirely disappear, leaving an empty neurilemmal tube. The severed axis-cylinder in the upper

segment grows downwards, in search of an empty neurilemma into which it may penetrate. Should it not succeed in finding one, it follows a devious course. A number of such wandering fibres, each with a knobbed extremity, bound together in a fibrous stroma, forms a neuroma. (Fig. 2.) When a nerve trunk is completely severed, such a neuroma may form a considerable growth at the extremity of the upper segment. If partially divided, the growth may form on one side or—in the case of a penetrating wound—in the centre of the nerve. The lower extremity is apt to be bulbous from fibrous formation. (Fig. 2.)

Fig. 2.—From *Revue de Neurologique*, May-June, 1915.



proportion (about one-fifth) of wounded nerves is there complete division. In such, the two ends may retract for some distance and remain wholly unconnected. Sometimes, however, the ends are united by a fibrous band. When the division is almost complete, a similar band, containing a few nerve-fibres, may be met with.

Compression of nerve-fibres.—When nerve-fibres are

severed, immediate paralysis (motor or sensory) follows, and the same may happen if they are suddenly compressed by a splinter of bone or fragment of metal. Less frequently, the symptoms due to nerve implication come on gradually, as the result of compression of an intact nerve-trunk by cicatricial tissue or callus. It is often found enveloped in a collar of dense fibrous tissue. More frequently the compressed nerve is partially severed, in which case the symptoms due to compression are added to those due to severance.

Nerve concussion.—It occasionally happens that symptoms (motor, sensory, vaso-motor, trophic) occur, and yet the affected nerve, when exposed, is found to be intact, though irresponsive to Faradic stimulation. Such cases have been ascribed to nerve concussion. Inasmuch as they occur after bullet wounds rather than from wounds inflicted by shrapnel, it is possible that the block is due to the heat generated by the bullet, travelling as it does at enormous speed through the tissues. In some of these cases the nerve has a grey, or even blackish, appearance, suggesting an actual structural alteration.

The relative frequency with which individual nerves are injured.—The nerves of the upper limbs are injured about two-thirds as frequently as those of the lower limbs. In the upper limbs, the musculo-spiral is most often injured, though lesions of the median and ulnar are common. These two may be affected together. In the lower limbs, the sciatic, as might be expected, is most frequently injured. Of its two divisions, the external popliteal is more often damaged than the internal branch. Injuries of other nerves giving rise to definite localizing effects, such as the cranial nerves, the circumflex, the internal pudic, the anterior crural, are comparatively rare. A fair number of cases of injury of the cervical sympathetic have been recorded.

The individuality of nerves.—This war has emphasized the fact, not perhaps adequately realized before, that many nerves behave, when injured, in a manner peculiar to themselves. Thus, while quite a small injury of the musculo-spiral produces wrist-drop with rapid loss of Faradic irritability, it rarely causes pain, vaso-motor, or trophic disturbances. In lesions of the median, on the other hand, pain is almost constant, while vaso-motor and trophic disturbances

are common. These effects are less common in lesions of the ulnar. Pain, again, is a common feature in lesions of the sciatic from involvement of the fibres to its internal branch, which is said to behave like the median, the external branch comporting itself more like the musculo-spiral.

The effects of nerve injury.—Let us now consider *seriatim* the motor, sensory, vaso-motor, trophic, and secretory effects resulting from injury of the peripheral nerves. The injury may cause :—Complete or partial severance of a nerve-trunk; sudden block by the compression of a bony splinter or metallic fragment; sudden block from concussion; gradual block by the compression of callus or cicatricial tissue; irritation from inflammation or compression.

Motor effects.—When motor fibres are severed or blocked, the muscles they supply become immediately paralysed, flaccid (hypotonic), and incapable of reflex contraction, superficial or deep. Rapid atrophy ensues. When this is complete, they are obviously incapable of responding to any kind of stimulus, but, while atrophy is proceeding, they respond abnormally both to mechanical and electrical stimuli. Thus a tap causes the affected muscles to contract with undue readiness (ideo-muscular irritability), while the electrical responses, known as the reaction of degeneration, gradually supervene, and may be obtained in their complete form as early as the fourteenth day after division of a nerve-trunk.

Another effect which follows upon the blocking of a motor nerve is loss of muscle sensibility, seeing that (in the case of the trunk and limb muscles at least) the same nerves which supply the muscles with motor fibres convey their sensory fibres also. The above effects come on more gradually when the nerve-block occurs as the result of gradual compression. It has to be remembered that functional paralysis (motor and sensory) may be added to that due to organic nerve injury, and great care may be needed in discriminating between the functional and organic effects.

The sensory effects.—These consist of anæsthesia paræsthesia and pain, and may involve all the tissues, superficial (skin) and deep (muscles, tendons, ligaments, bones, etc.), supplied by the damaged nerve.

As might be expected, the sensory effects of nerve lesions, notably the anæsthesia, are apt to be aggravated by the

presence of vaso-motor disturbances.

Pains and paræsthesias are most frequent in lesions of the median and sciatic. They are due to irritation of the nerve-fibres, and occur more frequently after partial than complete severance of a nerve-trunk. The most common source of the irritation is compression from callus or fibrous tissue formation. In rare cases, a secondary neuritis would appear to be responsible for the pain. The pain generally comes on from ten to fifteen days after the wound.

The pains affecting the distribution of the median and sciatic are of two kinds: the so-called "causalgic" and the "neuralgic." In the former variety, they are felt chiefly in the palm and finger tips, and in the soles of the feet, in which regions touch-organs are unusually abundant. It is of interest to note that the median supplies the thumb and just those fingers and that portion of the palm which subserve *par excellence* stereognosis (sense of relief), for these are the parts which are especially involved in feeling an object with the fingers and thumb. They are all richly supplied with Meisner's corpuscles and Rufini's bodies, as well as with Pacinian bodies. We may presume that their cerebral representation is correspondingly complex; it is not, therefore, surprising that lesions of the median should be liable to give rise to protracted pain felt especially in the hand. Attention has also been drawn to the fact that the median and sciatic are each supplied with a nutrient artery of exceptionally large calibre.

The pain in this causalgic form is often excruciating. It may be excited by the slightest contact of the affected limb or even of the opposite one, and is aggravated by dry heat, strong emotion, noise, or bright light.

In the neuralgic type, much less common than the last, the pains are more shooting in character and tend to follow the course of the nerves.

Pains due to nerve injury, more especially those of the causalgic type, are only exceptionally benefited by operation. They appear some days after the wound, gradually reach a maximum intensity, and, after lasting for months, diminish spontaneously. Nothing, says Léri, can alter their course; they are "inexorable." They are best relieved by cold, damp applications. It is not always easy to distinguish

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As might be expected, the sensory effects of nerve lesions, notably the anæsthesia, are apt to be aggravated by the

severely injured nerve, no improvement has occurred after two months, most surgeons would operate. Operation is also emphatically called for, if a considerable neuroma or fibroma can be felt, or if there is evidence of pressure by adhesions, or by a splinter of bone or metallic fragment (as shown by radiography).

There is no need to describe the operative procedure in detail. If the nerve is completely divided, the neuro-matous growth is removed from the upper portion and the lower end trimmed to the needful amount. If a wide interval separates the two ends, it has been recommended, where possible, to graft them into a neighbouring nerve in the hope that the latter may serve as a conduit for the down-growing fibres from the upper to the lower segment. Should the two ends be united by a fibrous band containing nerve fibres, it may not be considered advisable to divide the band. The presence within such a band of healthy nerve-fibres can be tested by means of Faradic stimulation. In this way, too, the lower fragment of the divided nerve may be identified, if degeneration of its fibres has not proceeded too far. Some surgeons, in order to prevent the formation of adhesions, surround the sutured portion of the nerve with pieces of artery (obtained from the calf), hardened in formol and preserved in alcohol. The fragments ultimately become absorbed. Others employ a portion of fascia lata derived from the patient. During the operation the limb is flexed, so that the two ends of the nerve may the more readily be brought together, and it is kept in the flexed position during the process of healing. When this is accomplished, the limb can only be straightened out gradually, because, unlike blood-vessels, nerve-trunks have little or no "give," and normally run a straight course to their destination.

In the case of an incompletely divided nerve, any neuro-matous or fibrous growth which may be situated at the side or in the centre of the nerve must be carefully dissected out; and should the nerve be compressed by adhesions, or enveloped in a fibrous collar, it must be freed from them. Some French surgeons recommend that the freed nerve should be lubricated with oil, so as to prevent the subsequent formation of adhesions. For the purpose of adequately liberating a nerve from fibrous adhesions, Hoffmeister advocates the endoneural injection of a novocain-suprarenin solution (1 minim

between the genuine sufferer and the malingerer, especially in the case of the sciatic nerve.

Vaso-motor effects.—The most frequent vaso-motor disturbance is a local contraction of the blood-vessels, diminished arterial pulse (with, it is said, a local fall in blood-pressure), sluggish circulation, cyanosis, and fall of temperature. Local œdema may occur. I believe that spasm of the venules is largely responsible for the cyanosis and œdema. A further factor in this form of local circulatory disturbance is muscular paralysis, in consequence of which the local venous flow is no longer aided by means of rhythmic muscular contractions.

Trophic effects.—The local circulatory disturbances just referred to necessarily lead to some degree of malnutrition; but, over and above such indirect trophic effects, disturbance in nutrition may occur as the direct result of faulty nerve action. The most familiar instance is the muscular degeneration which occurs secondarily to the blocking of motor nerve-fibres. Other trophic changes which may occur are: Glossy skin, keratosis, chronic indolent ulceration, brittleness and curving of the nails, which cease to grow (and do not require to be cut), overgrowth of the hair, falling out of the hair, rarefaction of bones (as shown by radiography), and articular changes similar to those which occur in rheumatoid arthritis. The latter occur after irritative rather than after destructive nerve-lesions.

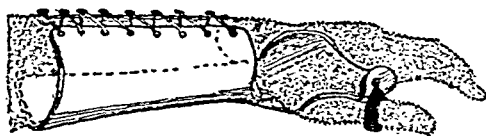
Secretory.—Hyperidrosis and dryness of the skin are occasionally met with.

TREATMENT.

In treating a case of injured nerve, the main point we have to decide, so soon as all suppuration has disappeared—about two or three weeks after the injury—is whether operation should be resorted to.

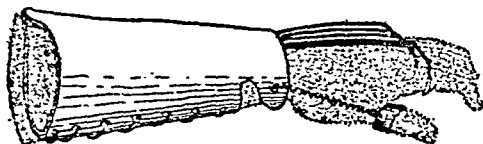
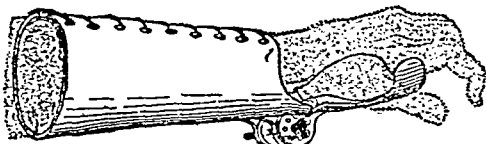
Operation.—Although a goodly proportion of cases of nerve injury recover spontaneously, there is a growing opinion that operation is advisable in most, if not all, of them. No harm can be done by a skilfully performed operation, while, if undertaken early, it holds out the best chances of speedy recovery.

It goes without saying that if there is evidence that the injured nerve is completely divided, an attempt should be made to suture the two ends. If, again, in the case of a

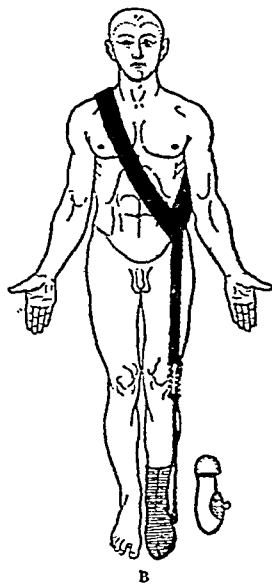
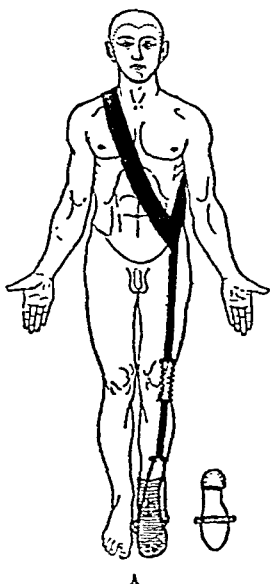


Supporting apparatus for "wrist-drop" (musculo-spiral paralysis). Leather armlet supporting a gutter of aluminium where the hand rests horizontally permitting flexion of the fingers. The thumb is supported by a leather ring.

Articulated supporting apparatus allowing flexion and extension of the hand on the forearm (musculo-spiral paralysis, with contraction of the flexors).



Spring apparatus, maintaining the fingers and the hand horizontal (paralysis of the extensors of the wrist and fingers). The thumb is separated by a leather ring fixed to a spiral spring.



Shoulder-belt passing over the shoulder opposite the affected foot, and supporting an elastic strap fixed to the sole of the footgear: A, by two attachments (paralysis of all the extensor muscles of the foot); B, by one attachment to the outside edge (paralysis of the external popliteal).

Fig. 3.—Apparatus for "wrist-drop and foot-drop." After Meige—from the "Revue de Neurologique."

of suprarenin to every 10 c. cm. of a 0·5 per cent. solution of novocain). The injection causes a swelling of the nerve, and he claims that this not only serves to break down endoneural strands of fibrous tissue, but, by causing hour-glass constrictions of the nerve, indicates the presence, and need for division, of fibrous constrictions which would otherwise escape observation.

Owing to the extreme vulnerability of nerves, it is necessary, in all these procedures, to handle them with the utmost care.

Mode of recovery after operation.—Recovery of function in the shape of a return of sensibility, myotonus, and of voluntary, electrical, and reflex excitability, and the clearing up of vaso-motor, trophic, and secretory disturbances, takes place, as might be expected, more quickly after operation for relief of compression than after suturing a divided nerve. In the former case some voluntary contractibility and some sensibility may return within a few days of the operation, even, indeed, on the day following it. The degree of compression naturally influences the rate of recovery. If, for instance, it has been such as to cause a complete local destruction of nerve-fibres, the condition is only one degree better than that of actual section.

The time which has elapsed since the occurrence of the injury also influences prognosis. Broadly speaking, the shorter the interval the more rapidly does recovery take place. If it has been sufficiently long to allow the paralysed muscles to undergo complete degeneration, recovery of contractibility is manifestly impossible. If, on the other hand, the degeneration of the muscle fibres has not proceeded far, the clearing up of the paralysis is correspondingly rapid.

The length of fibre below the seat of injury has also to be taken into account in prognosis: the longer this is the longer will it take the down-growing axis cylinders to reach their destination. For this reason, the tissues supplied by those branches of the affected region which come off first tend to recover first.

The order in which the various defects of junction are recovered from after complete severance of a nerve-trunk.—On this subject prolonged and careful observation is still necessary. It is said that sensibility tends to reappear before voluntary contractibility, and both before reflex

THE TREATMENT OF JAW INJURIES.

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[With Plates I. and II.]

GUNSHOT wounds of the jaws have long been recognized as some of the most distressing injuries of a non-fatal nature with which the surgeon has to deal.

Heath, in his work on *Diseases and Injuries of the Jaws*, records many terrible cases of this kind, which occurred in the Napoleonic wars. He mentions cases in which large portions of the mandible had been blown off, and the resulting facial deformity and loss of function were so distressing that the sufferer not infrequently committed suicide. At that time, very little could be done in the way of treatment beyond providing a mask to conceal the deformity, and a metal box containing sponges strapped to the chin to catch the escaping saliva.

In the present war, owing to the conditions of trench warfare and the enormous increase in the expenditure of ammunition, jaw wounds are far more numerous than ever before. As a result, too, of the modern high velocity bullet, and the jagged splinters of high explosive shells, the injuries are frequently of the most terrible kind, large portions of the mandible or even the whole being often torn away.

Happily, however, the treatment of these injuries has been changed completely by the brilliant work of Claude Martin, a French dental surgeon of Lyons. The methods advocated by him, and now universally adopted throughout France, render it possible so to improve the condition of even the worst cases, that speech and partial function can be restored, thus making the patient's life tolerable, and, in the majority of cases, quite normal again. See Cases 1 and 2 (Plate I.).

TYPES OF INJURIES.

Wounds of the upper jaw require very little special attention. Owing to the attachment of the superior maxilla

contractibility. Vaso-motor and trophic disturbances are the latest to recover.

As regards the muscles, myotonus reappears first. There is a difference of opinion as to whether voluntary power or Faradic contractibility first returns. Contrary to what was taught by Duchenne (of Boulogne), and what is still maintained by many (*e.g.*, Dèjernie), it would appear that Faradic irritability returns first. Thus, in six cases of complete division of the sciatic nerve, Marie found that the latter returned in from five to six weeks after suture, while the earliest date at which voluntary power reappeared was 119 days after the operation, and 54 days after the appearance of Faradic excitability. In a case of suture of the musculo-spiral recorded by Dèjernie, voluntary contractibility did not show any sign of returning until the 176th day.

As regards sensibility, Head has shown that cutaneous sensibility does not return until a considerable period after suture of a divided cutaneous nerve, and he contends—although this view is not generally accepted—that what he terms “protopathic” sensibility returns sooner than the more delicate and discriminating “epicritic” sensibility. The present war is affording abundant opportunity of testing the order in which the various forms of sensibility—superficial and deep—are recovered after suture of divided sensory nerves. As yet, sufficient time has not elapsed to decide these points.

Surgical appliances.—Considerable help can be got in the treatment of motor paralysis due to nerve injuries by the use of suitable surgical appliances. It is, above all, necessary to prevent the permanent shortening of the non-paralysed antagonistic muscles, and to minimize their antagonizing action on the paralysed muscles while the latter are recovering. Thus, the extensors of the wrists and fingers, in musculo-spiral paralysis, are placed at a great disadvantage during the slow process of recovery, by the activity of the powerful flexors. To meet this difficulty, Meige suggests the employment of “artificial gutta-percha muscles” in the shape of gutta-percha bands, suitably attached to the forearm, wrist, and fingers. In the case of dropped foot, traction is obtained from the opposite shoulder. He, indeed, contends that, by such means, cure can often be effected, or at least expedited, without recourse to operation. (Fig. 3.)



Case 1A.—(*Before treatment.*)

Case 1B.—(*After treatment.*)

By kind permission of Dr. Léon Frey.



Case 2A.—(*Before treatment.*)

Case 2B.—(*After treatment.*)

By kind permission of Dr. Hotz (Paris).

to the cranium, the conditions of treatment are very much simplified, and most of the evil results following injuries to the mandible are entirely absent. Wounds of the mandible, on the other hand, present many difficult problems in treatment; this is partly due to its position of complete separation from the cranial skeleton except through the temporo-maxillary articulation, as well as to the various powerful stresses to which it is subjected by means of its attached muscles. Thus, almost every solution of its continuity leads to immediate displacement of the fractured parts, and no form of external splint will hold the parts in correct apposition in the large majority of cases.

Fractures of the mandible can be divided broadly into two distinct classes:—

1. Fractures *without* loss of substance.
2. Fractures *with* loss of substance.

These two varieties have been well named by Dr. Leon Frey, Peace fractures and War fractures.¹ It is entirely with War fractures, or fractures *with* loss of substance, that I propose to deal, since it is in these cases that nearly all the difficulties of treatment occur.

Any classification of these fractures is difficult, because loss of bone may occur in any part of the mandible. For purposes of description, however, we may roughly divide them into two types:—

Type 1.—Loss in the anterior part of the mandible, between the symphysis and the first molar.

Type 2.—Loss in the posterior part of the mandible, between the first molar and the condyle.

Such injuries are frequently bilateral. Thus, the front of the mandible may be blown away to the same extent on both sides; or, again, a bullet entering near the angle may cross the oral cavity and, in its exit, fracture the corresponding portion of the mandible on the opposite side.

The condition of the parts immediately after the receipt of the injury is often one of apparently hopeless confusion, as in Case 1, A. (Plate I.) The remaining portions of the mandible are displaced and often driven across the floor of the mouth by the force of the blow, while the soft tissues

¹ *Paris Médical*, August, 1915.

are left hanging down in ragged strips on the neck. It is at this early stage that the need for special treatment is most essential. The displaced fragments, being freely movable, can easily be pressed back into position, where they should be firmly fixed by some form of temporary interdental splint. Unfortunately for the patient, this appears to be very seldom done; the soft parts are sewn up around the still displaced bony fragments, and the resulting deformity thereby greatly increased. Cicatrization soon complicates the trouble, and, when treatment of the jaw is finally undertaken, the displaced fragments are usually bound down by dense cicatricial bands.

It is impossible to emphasize too strongly the need for immediate replacement and fixation of the displaced fragments in all jaw injuries, and, contrary to what has been often asserted, the introduction of a dental splint in the early stages tends to *reduce the sepsis*, and not to increase it. This is easily explained by the rest and support afforded to the parts by their fixation. Moreover, the comparative freedom from pain gained by this support allows of more extensive movements of the jaw by the patient, and thus greatly facilitates the cleansing and irrigation of the wound.

The evils attendant on the neglect of splinting the jaw at an early stage are exemplified in the following typical case, which is one of several seen by the writer in the last few months. The patient had been struck on the chin by a shell splinter, which had carried away the front of the mandible as far back as the bicuspid on each side. The posterior fragments had become drawn together across the floor of the mouth, and the soft tissues had retracted back over them, almost level with the centre of the palate. The tongue protruded from the cavity, and the escaping saliva flowed down the neck into a jaconet pocket tied there to receive it. Talking and eating were alike impossible, and the patient's life was a misery to him. Had a splint been introduced to fix the bony fragments and buttress out the soft parts before retraction had commenced, all these evils would have been avoided, and several months of after-treatment saved.

TREATMENT.

The objects of the treatment advocated by Claude Martin

PLATE II.



(Photo. C. Clark.)

Case 3A.—*Right side of mandible, showing multiple fractures caused by entrance of bullet, and downward displacement of anterior fragment from the point x.*



(Photo. C. Clark.)

Case 3B.—*Left side of mandible, showing extensive destruction of bone caused by exit of bullet.*

1. *Interfragmental pressure*.—This method is applicable where loss of bone has occurred in the anterior part of the mandible, and the remaining portions have become drawn together. Thus, in the case of fracture, Type 1, in which the anterior part of the mandible has been destroyed back to the bicuspid or first molars, the remaining lateral portions become drawn inwards across the floor of the mouth, where the extremities may even touch. (Fig. 1.) An expanding

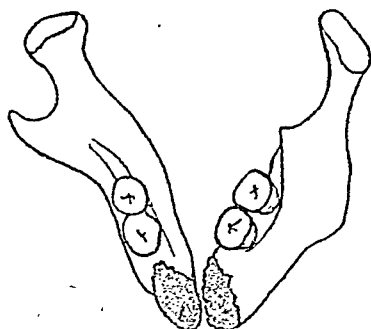


Fig. 1.

splint for this condition is constructed as follows:—A cast metal capping is made for the teeth of both fragments, and the cappings of the two sides are united by an expanding spring or screw. (Figs. 2 and 3.) This splint is cemented

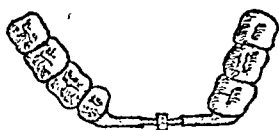


Fig. 2.—Expanding screw splint.

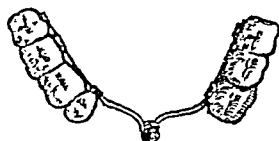


Fig. 3.—Expanding spring splint.

to the teeth, and will separate the fragments to any desired degree. If preferred, a removable vulcanite splint on the same lines can be used instead of the above.

The fragments having been reduced to their correct position relative to the upper jaw, a fixed splint is substituted for the expanding one. Similar cast metal cappings are made to the teeth of each fragment, the tops of the cappings being cut away to allow the cusps of the teeth to articulate with the opposing teeth of the upper jaw. In place of the

are two :—

First.—To re-establish the physiological functions of the jaws.

Second.—To restore the normal outlines of the face.

These objects are attained almost entirely by the use of splints—*traitement non sanglant*—and surgical intervention is only occasionally needed for the initial sewing up of the soft parts, and for skin grafting when there is much loss of soft tissues.

The treatment is divided into three distinct stages :—

- I.—Correction of displacement and fixation of the bony fragments.
- II.—Reduction of cicatricial contraction and re-moulding of the facial contours.
- III.—Fitting of a permanent prosthetic appliance to replace lost parts and restore function.

I.—CORRECTION OF DISPLACEMENT AND FIXATION OF THE BONY FRAGMENTS.

The duration and difficulties of this stage are directly proportional to the period of time which has elapsed since the date of the injury.

If the injury is only a few days old, the bony fragments will still be freely movable, and can usually be replaced in their correct positions by digital pressure alone, where they must be firmly fixed by a splint, such as that shown in Fig. 4. When, however, as is most commonly the case, several weeks have elapsed before treatment is commenced, the fragments will be found firmly fixed in malposition by cicatricial tissue, and *traction splints* must be employed to overcome the resistance. Traction splints are of three main varieties, according to the nature of the resistance which they have to oppose.

1. *Interfragmental*, i.e., pressure applied between the remaining fragments.
2. *Intermaxillary*, i.e., pressure applied between the upper and lower jaws.
3. *External*, i.e., pressure applied from outside the mouth as from a skull cap.¹

¹ Monomaxillary—Intermaxillary—Craniomaxillary of Dr. Leon Frey.

elastic bands, and the lower fragment moved by this means in any desired direction. (Fig. 5.)

This method is especially useful to correct downward displacement of the mandibular fragments.

3. *External pressure.*—In certain cases, no point of support can be obtained within the mouth, and pressure must then be directed from outside, as from a head cap.

This method is especially valuable when the whole of one side of the mandible has been destroyed. In such a case, the remaining half is drawn across to the injured side by muscular action, and intermaxillary traction is very difficult to apply.

A suitable head cap is made as follows:—A metal band one and a half inches deep is fitted round the head, passing across the forehead and above the ears. To this is soldered a flat metal bar in front of the ear on the sound side, which is prolonged downwards in a line with the ramus to the angle of the mouth, where it terminates in a loop. A cast metal splint is fixed to the teeth of the mandibular fragment,



(After Martinier and Lemerle.)
Fig. 6.—A. Dental splint. B. Elastic.

from which a metal bar is prolonged between the lips, where it also terminates in a loop. By exerting elastic traction between the metal loops of the internal and external splints, sufficient pressure can be applied to draw the mandibular

intervening spring or screw, a rigid metal bar is soldered between the two sides, which follows approximately the normal curve of the jaw. (Fig. 4.)

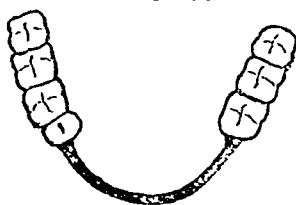


Fig. 4.

This splint is firmly cemented to the teeth, and holds the parts in rigid continuity. Some degree of mastication is thus immediately restored. It may be compared to the plating of a long bone, but with this advantage, that instead of being attached to the bone itself, it is fixed to parts exterior to it, thus avoiding the introduction of a foreign body into the wound.

2. *Intermaxillary pressure*.—This form of traction is useful in many cases in which interfragmental pressure is not easily applicable. The *point d'appui* in this case is the superior maxilla. A metal collar is fitted round an upper molar tooth of each side, to which is attached a curved wire running round the external surfaces of the front teeth. A number of small metal hooks are soldered at intervals along the wire. A metal cap splint is cemented to the teeth of the displaced mandibular fragment or fragments, bearing similar metal hooks on its external surface. Traction can then be exerted from the upper to the lower hooks by means of

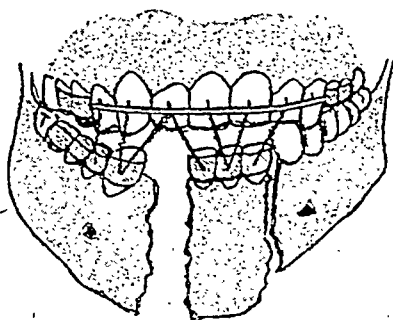


Fig. 5

bullet had passed through the mandible on both sides, in the region of the angle, a piece of the bone, including the wisdom tooth on the entrance side, the lower third of the ramus, part of the angle and the wisdom tooth, on the exit side, had been carried completely away through an exit wound not larger than a shilling. Case 3 (Plate II., page 75). In other cases, there is extensive laceration of the soft tissues, especially as the result of shell splinters, but very seldom is there any actual loss of these parts. This fortunate state of affairs has a most important bearing upon the treatment under discussion. One other fact of great importance needs emphasizing in this connection, viz., the extensile property of newly-formed cicatricial tissue. Cicatricial tissue, when newly formed, has an almost infinite capacity for dilatation, and, containing but few elastic fibres, has very little tendency to retract afterwards.

The second stage of Claude Martin's treatment depends entirely for its success on these two factors:—*The very slight loss of the soft tissues, as compared with the hard, and the power of dilatation of newly-formed scar tissue.*

Before attempting the actual dilatation of the tissues, they must first be rendered soft and pliable by means of *massage*. The massage consists of rubbing and rolling the retracted tissues beneath the hand for ten minutes twice or thrice daily, and should be continued throughout the whole period of dilatation.

Dilatation of the tissues is carried out from within the mouth in the following way:—If we take a case in which the

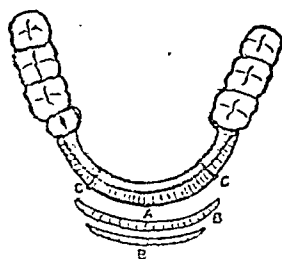


Fig. 8.—A. *Vulcanite bar*. B. *Extra layers*. C. *Screws*.

front of the mandible has been blown away, and the soft tissues have retracted back on to the ends of the fractured

fragment into correct position. (Fig. 6.)

No fixed splint, such as that previously described, is applicable in a case of this kind, since there is only one fragment present. The permanent support is, therefore, also provided from the superior maxilla. A metal splint is fixed to the mandibular portion carrying a vertical plate on its external or labial aspect. A similar plate fixed to the upper teeth, or to an upper denture on the same side, engages the internal surface of the lower plate, and these plates or slides are so arranged as to remain in contact in all positions of the jaw. (Fig. 10 (3 and 3¹), page 83.)

Another condition, in which the head cap is very useful, is in the case of fracture behind the last molar tooth, either at the angle or in the ascending ramus. The displacement of the anterior portion can be reduced, if in a horizontal direction, by the method described above, or, if in a vertical direction, by the use of a chin cap and bilateral traction. (Fig. 7.)

II.—REDUCTION OF CICATRICIAL CONTRACTION AND REMOULDING OF THE FACIAL CONTOURS.

A very marked feature of the majority of bullet wounds is the great difference between the loss of hard and soft tissues respectively. One often sees cases in which a bullet has passed through a limb, making only a minute puncture

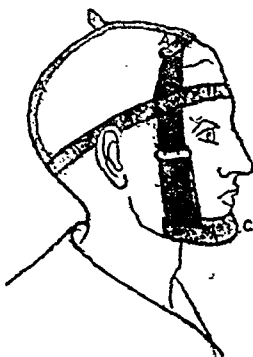


Fig. 7.—A. Webbing. B. Elastic. C. Metal chin cap.

at its entrance, and a wound no larger than a halfpenny at its exit, yet two or three inches of the long bone are entirely missing. In a recent case of the writer's, in which a

bullet had passed through the mandible on both sides, in the region of the angle, a piece of the bone, including the wisdom tooth on the entrance side, the lower third of the ramus, part of the angle and the wisdom tooth, on the exit side, had been carried completely away through an exit wound not larger than a shilling. Case 3 (Plate II., page 75). In other cases, there is extensive laceration of the soft tissues, especially as the result of shell splinters, but very seldom is there any actual loss of these parts. This fortunate state of affairs has a most important bearing upon the treatment under discussion. One other fact of great importance needs emphasizing in this connection, viz., the extensile property of newly-formed cicatricial tissue. Cicatricial tissue, when newly formed, has an almost infinite capacity for dilatation, and, containing but few elastic fibres, has very little tendency to retract afterwards.

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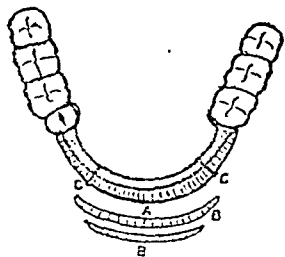


Fig. 8.—A. Vulcanite bar. B. Extra layers. C. Screws.

front of the mandible has been blown away, and the soft tissues have retracted back on to the ends of the fractured

portions as already described, we must suppose that stage 1 has already been completed, and that the remaining fragments are fixed in proper position by a fixed splint as in Fig. 4. A curved vulcanite bar is screwed to the anterior face of the metal bar of the splint, resting upon the soft tissues below, and also pressing against those of the chin and lip in front. (Fig. 8.) Thin plates of vulcanite or hard rubber are added to the external surface of the vulcanite bar, every two or three days, with the double object of forming a furrow or sulcus on the floor of the mouth in which an artificial jaw can finally rest, and also of pressing out the tissues of the chin and lip to their normal position relative to the face generally. This process is necessarily a long one, often requiring several weeks or even months for its successful accomplishment, especially in old standing cases, in which dense cicatricial bands have formed.

When soft tissue is actually missing, particularly in the case of the lower lip, a plastic operation should be undertaken at the completion of this stage. The hard vulcanite splint, representing the normal outline of the mandible, affords a most valuable guide and support in the placing of the graft.

A word must be said here on the subject of bone grafting. If it is desired to attempt this operation, dilatation of the soft tissues should be carried out to the full extent first. The vulcanite bar and its additional layers should then be removed, leaving the fixed splint in position. The metal bar of the splint, if properly designed, does not interfere with the placing of the graft, and the absolute rigidity of the fragments prevents any tendency to shifting of the newly-implanted portion. The graft, a portion of resected rib, can be inserted through an incision from outside, thus preventing any possibility of infection from the mouth.

Enough has been said to indicate the general outlines of this stage of treatment, and it only remains to mention the final substitution of an artificial jaw to replace lost parts and restore function, in that very large proportion of cases in which, for various reasons, bone implantation cannot be undertaken.

III.—FITTING OF A PERMANENT PROSTHETIC APPLIANCE TO REPLACE LOST PARTS AND RESTORE FUNCTION.

The method of constructing an artificial jaw is very

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SALVARSAN AND NEOSALVARSAN

EFFECTIVE SUBSTITUTES.

GALYL

GALYL is tetraoxydiphosphaminodiarsonobenzene and has been discovered by Dr. MOUNEYRAT.

It is found in the form of a clean yellow powder, liable to change when exposed to the air.

GALYL is as effective as SALVARSAN or NEOSALVARSAN on Spirochætes and Trypanosomes and free from the neurotropic and congestive action of these preparations.

FOR INTRAVENOUS INJECTIONS:—

(1) **DILUTE.**—GALYL is supplied in neutral glass ampoules containing the necessary dose of Sodium Carbonate. Sterile distilled water being only used for the dissolution.

(2) **CONCENTRATED.**—A special outfit containing one dose GALYL, one ampoule sterilised solution, and one small filter is supplied.

DOSES: 0·20—0·25—0·30—0·35—0·40.

For INTRAMUSCULAR INJECTIONS GALYL is supplied in oily emulsion.

DOSES: 0·20—0·30—0·40.

HECTINE

HECTINE is Sodii Benzo-sulpho-p-amino-phenyl arsonas.

HECTINE consists of colourless needles, very soluble in water, containing approximately 21 per cent. of arsenic.

The preparation is put up in sterile ampoules for INTRAMUSCULAR INJECTIONS:—

AMPOULES A containing 10 cg. in 1 c.c.

AMPOULES B " 20 cg. in 1 c.c.

PILLS " 10 cg.

Ref., THE LANCET, 26/6/15—

"Severe case of intractable syphilis treated satisfactorily with Hectine."

HECTARGYRE

Mercurial salt of HECTINE, a combined arsenico-mercurial treatment of Syphilis, especially recommended after a course of Galyl.

The preparation is put up in sterile ampoules for INTRAMUSCULAR INJECTIONS:—

AMPOULES A containing:

Hectine .. 10 cg.
Hg. .. 1 cg. in 1 cc.

AMPOULES B containing:

Hectine .. 20 cg.
Hg. .. 1 cg. in 1 cc.

PILLS containing:

Hectine .. 10 cg.
Protoiod of Hg. 1 cg.
Opium Extract 1 cg.

IN PHIALS OF 24 PILLS.

Complete literature on application to the Sole Agents for the British Empire, Colonies and Dominions—
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similar to that of making an ordinary denture. It is made to a model of the mouth, and artificial teeth are provided in place of those that are missing. The only points of interest are those relating to the attachment of the artificial jaw to the mandibular fragment or fragments.

To restore the anterior part of the mandible, including the chin, two methods of attachment can be employed. The artificial jaw can either be attached by means of removable screws to the bar of the fixed splint, in the same way as the vulcanite bar for dilating the tissues, or the fixed splint can be dispensed with, and the jaw attached directly to the teeth by means of clasps. (Fig. 9.) The former

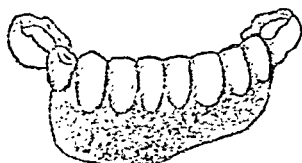


Fig. 9.

method has the advantage of superior rigidity, and, therefore, possibly more efficient mastication; it has, however, the disadvantage, which is inseparable from all bridge work, of locking the teeth together and thereby probably shortening their useful life.

In the case of the restoration of the entire half of the mandible on one side, either of the above methods of attachment can be utilized, but, in addition, a spiral gold spring, of the ordinary dental pattern, must be provided, attaching the artificial jaw to a small plate fixed to the upper teeth on the injured side, to prevent the muscles of the floor of the mouth from lifting the jaw on this side. Vertical slides

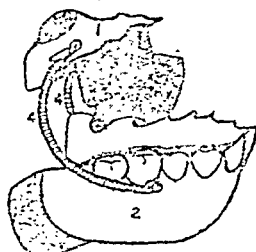


Fig. 10.—1. Upper palate. 2. Artificial mandible. 3 and 3'. Vertical slides. 4. Springs.

as already described, must also be incorporated with this appliance, to prevent the mandible from swinging inwards. (Fig. 10.)

In this very short *résumé* of Claude Martin's treatment, it has been impossible to give any but the briefest description of the methods and appliances employed. The broad principles, as described, are the *early replacement and fixation of the fractured parts and the dilatation of the soft tissues*. The exact details of management must be left to the ingenuity of the operator, who must adapt his methods to the requirements of each case. To anyone wishing to pursue the subject further, the writer would strongly recommend a visit to Paris. He has himself, in conjunction with three colleagues, lately had the opportunity of seeing this work in the hospitals of Paris, and the results of treatment which they saw there were such as would convince anyone of its efficacy.

The methods employed in the various hospitals differ somewhat in their details. Thus, at the Val-de-Grace (Dr. Leon Frey) and the École Dentaire (Dr. Roye) fixed splints of cast silver were chiefly used, while at Auxiliary Hospital No. 39 (Dr. Hotz) removable vulcanite splints were mostly employed. In the American Ambulance at Neuilly, again, the splints were usually of German silver struck to a model of the mouth.

In conclusion, one may express the hope that these methods may become more widely known in this country, so that the numerous cases of jaw injury may receive appropriate treatment before it is too late to obtain the best results.

BIBLIOGRAPHY.

- Martinier et Lemerle: *Prothèse Restauratrice Bucco-faciale*.
Claude Martin: *Prothèse Immédiate*.
Leon Frey: *Paris Médical*.
Heath: *Injuries and Diseases of the Jaws*.

TYPHOID INOCULATION IN THE FORCES.

BY ALEXANDER FLEMING, F.R.C.S., LATE TEMPORARY
LIEUT. R.A.M.C.

*Assistant Lecturer in Bacteriology, St. Mary's Hospital Medical School,
and Pathologist to the London Lock Hospitals.*

PROPHYLACTIC inoculation with a vaccine against typhoid fever was first practised by Sir Almroth Wright on a large scale during the South African War.

The results of typhoid vaccination in the South African campaign have been the subject of much controversy. We know now, however, that the statistics of typhoid during that campaign were very faulty. Then the diagnosis of typhoid fever was made merely by clinical signs, or possibly by testing the serum to know whether it gave a positive Widal reaction or not. From the experience of the last ten years, and especially by our experience during the present war, we know that the clinical diagnosis of typhoid fever is very fallible, and very many cases of fever, due to some one of the other members of the coli-typhoid group of organisms, present symptoms indistinguishable from true typhoid fever, while some cases of true typhoid present quite anomalous symptoms.

As regards the Widal reaction, the introduction of prophylactic inoculation has complicated the diagnosis enormously. Inoculated men for a long time show a positive Widal reaction, so that, in the inoculated man, a single test of the blood serum by this reaction is quite useless, or, if the medical officer in charge is unaware of this, is distinctly misleading.

We see, therefore, that in the early days of inoculation the statistics did not accurately show the true value of the vaccine, and it might have been that progress in this direction would have been stopped—for a considerable time at any rate—had it not been for the pertinacity of Sir Almroth Wright and his followers at the Royal Army Medical College, who were able to establish clearly the value of the vaccine.

During the present century, evidence has been accumulat-

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siderable fever and malaise, which may last, in exceptional cases, for 48 hours, although usually the toxic symptoms have disappeared within 24 hours. The reaction is worse in alcoholics, and all alcohol should be forbidden for two days after inoculation.

The serious dangers of antityphoid inoculation, of which we have heard much from the anti-vaccinationists, do not seem to exist.

DURATION OF THE IMMUNITY.

This is a point which is very difficult to determine with accuracy. For a varying time after inoculation—in some cases for several years—immune substances can be found in the blood of the inoculated person. It has been shown also that even after all demonstrable immune substances had disappeared from the blood, yet the previously immunized person responds much more quickly to another inoculation. This shows that some sensitiveness had remained whereby the individual could more rapidly mobilize the forces of his immunity to combat an infection.

Some highly significant observations in this direction have been made in connection with our Army in India. In the pre-inoculation days, the most dangerous period, as regards typhoid, was the first year of the soldiers' sojourn in India. Now, however, when almost the whole of the British troops in India are inoculated, the maximum case incidence is in the third year. This would seem to show that the immunity conferred by the vaccine lasted at least two years.

RESULTS OF TYPHOID INOCULATION TO THE BRITISH EXPEDITIONARY FORCE IN FRANCE.

The figures relating to typhoid fever are given in Tables I., II., and III.

TABLE I.

Up to beginning of May 1915:—

	Inoculated.	Uninoculated.
No. of cases - - - -	299	481
Deaths - - - -	20	100
Per cent. mortality - -	6.7	20.8

ing showing the extreme value of inoculation, both from our army in India and from abroad.

During the Mexican disturbances several years ago, the American Army was mobilized on the Mexican border, and there was not a single case of typhoid fever reported—an absolutely unheard-of thing previously. In the United States Army, inoculation was compulsory, and so there were no controls. We know, however, that typhoid fever is endemic in those regions, and it is very remarkable that a large number of men could be encamped there for a considerable time without the occurrence of a single case.

PREPARATION OF THE VACCINE.

The vaccine used in the English Army is made by growing the typhoid bacillus on agar or broth. If grown on agar an emulsion is made of the bacilli in normal salt solution. The bacilli are enumerated by Wright's method of counting (comparison with the number of red corpuscles in blood), and they are killed by heat at 53° C., after which heating some of the vaccine is planted out aerobically and anaerobically to make sure that it is sterile. Finally, carbolic acid is added up to a strength of one-half per cent.

The official vaccine of the French Army is made from agar cultures. The sterilization is, however, effected not by heat, but by means of ether. Vincent claims for this that the reaction is less than with the heat-killed vaccine. Inquiry among medical officers in the French Army, however, failed to substantiate this claim, and most of those I met, who had used both the French and the English official vaccines, seemed to prefer the latter.

IMMEDIATE RESULTS OF INOCULATION OF THE VACCINE.

The most suitable site for the inoculation is subcutaneously in the chest about two inches below the middle of the clavicle. Two doses are given—one of 500 millions and another of 1,000 millions ten days afterwards.

Provided the syringe is efficiently sterilized, the chances of a septic injection are nil. There is often, however, considerable local reaction, the site of inoculation becoming red and tender. This persists for one or two days, then gradually fades. The general reaction varies enormously. Very often it is hardly perceptible, while, in other cases, there is con-

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the great value of the vaccine is further illustrated. Among the inoculated men the case mortality is only 6·7 per cent., as against 20 per cent. among the uninoculated. Now these cases have exactly the same treatment by the same doctors in the same hospitals, so that the comparison is a very fair one, approaching as near a crucial experiment as one can get in clinical medicine.

These figures show very clearly the great value of typhoid inoculation, both in reducing the case incidence and the mortality.

It was frequently found impossible to give more than

TABLE IV.

—	Inoculated.		Uninoculated.
	1 Dose.	2 Doses.	
No. of cases - - -	157	142	481
Deaths - - -	10	10	100
Per cent. mortality - -	6·36	7	20·79

one inoculation, and, in such cases, the dose given was 1,000 millions. The protection which this single dose has afforded has been, during the comparatively short period under review, practically the same as when two inoculations were given. This is shown in Table IV., giving the results up to the beginning of May, 1915.

It is probable, however, that the single inoculation does not give such lasting immunity as the double dose, and the authorities have recently been reinoculating all these men in order to maintain their high degree of resistance.

MIXED VACCINES.

The question of using mixed vaccines of typhoid and paratyphoid is one which has often cropped up since the beginning of the war, and it has recently been brought forward again by Castellani, at the Medical Society of London. Sir William Leishman has stated that, during the first fifteen months of the war, there have only been some 1,200 cases of paratyphoid in our Expeditionary Force in France, with a

TABLE II.

Up to September 19, 1915:—

	Inoculated.	Uninoculated.
No. of cases -	494	558
Deaths -	33	113
Per cent. mortality -	6.7	20.2

TABLE III.

Between May and September 1915 (over 90 per cent. of men inoculated):—

	Inoculated.	Uninoculated.
No. of cases -	195	77
Deaths -	13	13
Per cent. mortality -	6.7	17

Table I. gives the figures up to the beginning of May, 1915, as stated by Mr. Tennant in the House of Commons (reported in the *Lancet*, May 8th). It will be seen from that there were 299 cases of typhoid among the inoculated as against 481 cases among the uninoculated. Mr. Tennant stated that, at that time, 90 per cent. of the men in France were inoculated. The percentage case incidence before that time I cannot arrive at definitely, for the percentage of inoculated men was steadily increasing as they appreciated the importance of being protected against typhoid. Even supposing, however, as a low estimate, that half the original force were inoculated, and that by May the number had risen to 90 per cent., then the case incidence must have been very much less in the inoculated men.

Table II. gives the total number of cases up to September 15, 1915.

Table III. is arrived at by subtracting the figures up to May from the total figures as given in Table II. At the beginning of May, there were only 10 per cent. of uninoculated men. We have, however, between May and September, 77 cases of typhoid fever among the uninoculated. I think we may safely assume that, in September, the residue of unprotected men was even less than 10 per cent., but supposing it was still at that figure, then, if the vaccine gave no protection, the number of cases among the inoculated ought to have been about 700, instead of which it is only 195.

When we come to consider the mortality in typhoid cases,

CLINICAL OBSERVATIONS ON NINETY-EIGHT CASES OF PARATYPHOID FEVER.*

By HAROLD WILTSHIRE, M.A., M.D., M.R.C.P., LATE TEMPORARY
CAPTAIN R.A.M.C.

Assistant Physician, King's College Hospital.

In civil practice, paratyphoid fever has always been regarded as a rare disease, but the experience gained by the observation of 98 cases has led me to the conviction that it is much more common than is usually supposed. The customary description, that it resembles mild typhoid fever, is true of some cases, but others would be better compared with influenza; in fact, in a clinical respect, the gap between these two diseases is completely filled by paratyphoid fever.

GENERAL FACTS RELATING TO CASES OBSERVED.

Diagnosis.—These 98 cases were treated at No. 12 General Hospital of the Expeditionary Force in France. In every case, the clinical diagnosis was confirmed by bacteriological investigation carried out by Captain T. H. Just. His results may be summarized as follows:—36 cases gave a positive blood culture (17, para. A.; 19, para. B.), and in 14 of these the organism was isolated from the fæces as well. In 50 cases (9, para. A.; 41, para. B.), the diagnosis was made by isolation of the bacillus from the fæces. In 12 cases (all para. B.), both blood culture and fæces gave negative results, but the agglutinating power of the serum to this organism increased during the course of the disease.

Morbid anatomy.—The morbid anatomy of the disease could not be studied, since only one death occurred, and that at a time when no *post-mortem* was possible. In this case death was due to an empyema, the pus from which had the smell characteristic of bacillus coli, but was sterile on culture.

Typhoid inoculation.—Previous prophylactic inoculation against typhoid fever appeared to be without influence upon the occurrence or course of paratyphoid fever. According

* NOTE.—I am much indebted to Captain F. L. Napier for the great care with which he made observations upon many of these cases.

mortality of about one per cent. The question of the protection of the troops in France against paratyphoid infections is not, therefore, a serious one. A possible outbreak of typhoid is, on the other hand, always serious, and it has not been clearly established that as good immunity is conferred to typhoid by a mixed vaccine as by the typhoid vaccine alone. If, then, there is the slightest chance of the admixture of paratyphoid with the typhoid vaccine reducing the efficacy of the latter, then it would be very unwise to use the mixed vaccine. This was the view expressed by Sir William Leishman, and, in the face of the figures quoted above, one could not seriously advocate any other procedure.

In our armies in the Near East, however, where paratyphoid infections are more common, it might be well to protect against these by a vaccine. Even here it would seem wiser to immunize against typhoid while the men are at a base in England, and, later, give a further inoculation against the paratyphoid bacilli.

In arguments against inoculation, the fact that the incidence of typhoid has diminished among the uninoculated men (although it has not done so to the extent that it did among the inoculated) has been used as proof that sanitary efficiency was the cause of the diminution. Nobody will deny that the healthy condition of our armies in France is largely due to the excellence of our sanitary system, but, at the same time, one must not lose sight of the fact that, when a man allows himself to be inoculated, he is protecting not only himself but the rest of the community. Thus, if three-fourths of the men are inoculated, and are thereby protected against infection, the risk of the remaining unprotected moiety which is mixed haphazard with the protected men, is much less, and, consequently, the case incidence would be lower. At present, owing to efficient immunization and sanitation, together with the careful elimination of "carriers," there are only some 30 cases of typhoid fever under treatment in our hospitals in France.

I should like to thank Lieut.-Col. Harvey for kindly supplying me with the latest figures as regards typhoid fever in France.

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the end of the fourth day, the maximum degree of discomfort is reached. On the whole, the fever of onset may be said to rise a little more abruptly than is the case in typhoid fever, the fastigium being reached by the end of the third day.

Fastigium.—The fastigium lasts about six or seven days, during which the temperature shows an evening level of about 103° F., and morning remissions of two or more degrees, these remissions tending to increase towards the end of this period. Headache continues, and the patient lies in bed in an apathetic condition, taking little notice of what is going on around him, and showing an obvious preference for being left undisturbed. In a severe case, he may show slight mental confusion when questioned; or, if he answer correctly, will not do so without obvious mental effort. True delirium is very rare.

The pulse keeps regular, of good volume, and slow compared to the degree of fever, a rate of 90 per minute corresponding roughly with a temperature of 103° F. During this stage, some cough starts, and slight bronchitic signs may be found in the lungs, but expectoration is rare, unless the bronchitis is marked, or some further lung complication develops. The breath is heavy and unpleasant. The tongue is covered with white, or yellow-white, fur, but usually remains moist.

Diarrhoea persists until about the end of the first week, when it is succeeded by constipation. Local pain in the splenic or cæcal regions is common, and the abdomen is tumid and slightly tender until near the end of this stage, when it becomes normal again. On palpation, an elastic, slightly resistant, feeling is experienced. It is unusual to obtain signs of splenic enlargement. Spots may appear near the end of this stage, or during the next.

Defervescence.—About the ninth or tenth day of illness, the morning remissions of temperature will have become extensive, and lysis will commence. It is usually complete in four or five days. In some cases the symptoms abate gradually, and in proportion to the fever, but others may lose them completely while the temperature still shows considerable elevation.

Convalescence.—Lysis is followed by a rather tedious

to statements made by the patients, 50 were fully protected against typhoid fever (two doses within two years), 32 were partly protected (one dose within two years), and 16 were unprotected.

Paratyphoid A. and B.—It is impossible to distinguish between the two forms of paratyphoid fever by clinical means alone. On the whole, the illness caused by paratyphoid A. tends to be the more severe; but the differential diagnosis rests with the bacteriologist, and the following remarks apply equally to both.

Clinical variations.—The fact that the disease may resemble either typhoid fever or influenza speaks for the wide differences in degree of severity which may be seen. To take a more concrete example; in one instance, the fever persisted for 50 days, in another it was finished in five. It is probable that cases even more slight than the latter occur, but escape diagnosis, owing to their mild nature. Between these two extremes, such a diversity of cases is seen, that a common clinical type can scarcely be said to exist. This diversity is mainly due to variation in the course of development of active immunity, and in a small degree only to complications. In effect, the general description which follows is a somewhat artificial compound, built up of the signs and symptoms most frequently seen, and is one to which few cases would conform in all particulars.

Individual signs and symptoms have to be considered in greater detail later.

GENERAL DESCRIPTION.

Onset.—The onset is very like that of typhoid fever, the initial symptoms being headache, diarrhoea, and muscle pains. The headache starts as a dull pain, which rapidly increases in intensity, and sometimes becomes very severe. If not limited to the forehead and temples, it is usually most marked in this region. It is accompanied by increasing general malaise, anorexia, and thirst. Diarrhoea generally starts on the first day, but is rarely excessive; with it there may be an indefinite sensation of abdominal discomfort, or true intestinal colic. Slight general muscle aching is the rule, but more acute local pain may be present in the back or limbs. All these symptoms increase in intensity until, by

The 98 patients stated that the following symptoms were prominent at the onset:—headache, 71; general malaise, 53; diarrhoea, 27; myalgia, 23; abdominal pain, 21. Rigors occurred in 2 cases only, sore throat in 4, and vomiting in 3.

TEMPERATURE.

Onset.—

The actual temperature of onset was observed in very few cases. Most of these showed a height of 103° F. on the first or second day, and point to a correspondingly rapid ascent as the probably common type. (Charts 1, 2, 5, 12.) Against this, one case shows a slow “steppage” rise (Chart 4), and is of a type which conforms much better with the gradual development of symptoms reported by most patients.

The comparative evidence

afforded by the ascent observed in intercurrent and true relapses favours a “steppage” rise, spread over three days. It seems best to take this as a mean, on either side of

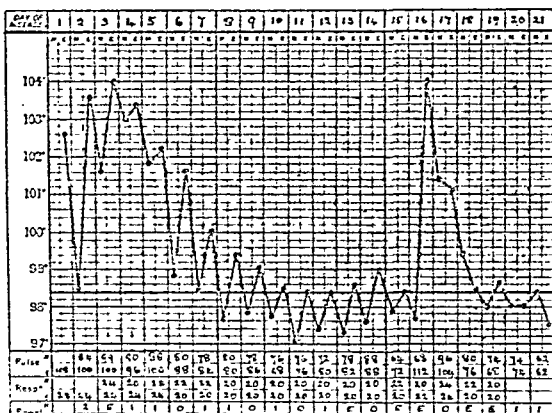


Chart 2. Para. B.

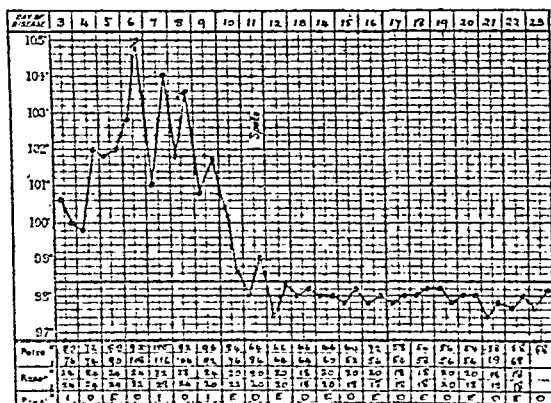


Chart 3. Para. A.

convalescence, the patient remaining free from symptoms, and failing to appreciate the degree of weakness to which the disease has brought him. As long as he is kept in bed, both temperature and pulse run a subnormal course, the former between 97° F. and 98° F., and the latter between 55 and 65 beats per minute. For the same period, constipation continues to require treatment. When the patient is allowed up again, the temperature rises to the normal line or even above it, and the natural action of the bowels is restored. At this stage the pulse commonly reveals a marked tendency to tachycardia, necessitating very careful supervision with regard to exercise and tobacco. As after typhoid fever, minor irregularities, such as constipation or excitement, are apt to cause a rise of temperature at any stage; and, even after a very mild attack, convalescence cannot be hurried through or lightly regarded.

SPECIAL SIGNS AND SYMPTOMS.

Symptoms of onset.—It is usual for symptoms to develop gradually. Of 50 cases in which the dates were noted, only 9 reported sick on the first day of illness, 4 of these stating that the onset was quite sudden. The remaining 41 gave an average of not reporting sick until the fourth day

of disease. In others, the duration of illness before reporting sick was quite indefinite, and it was strongly suspected that several had passed through a mild initial attack without treatment, and only re-

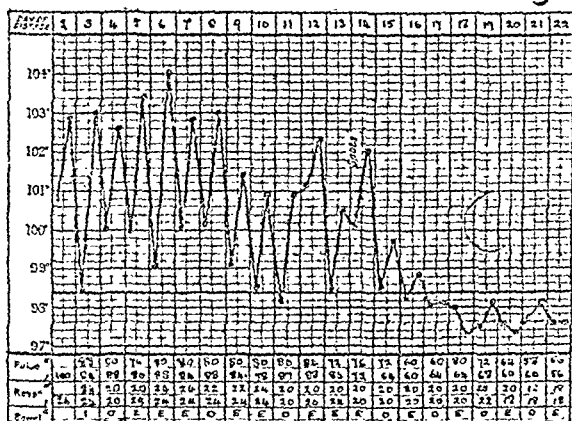


Chart 1. Para. B.

ported sick on the occurrence of an intercurrent or true relapse of greater severity.

immunity, ending in a complete victory for the latter. The occurrence of complications in some cases has doubtless increased the total average duration of fever, but it is im-

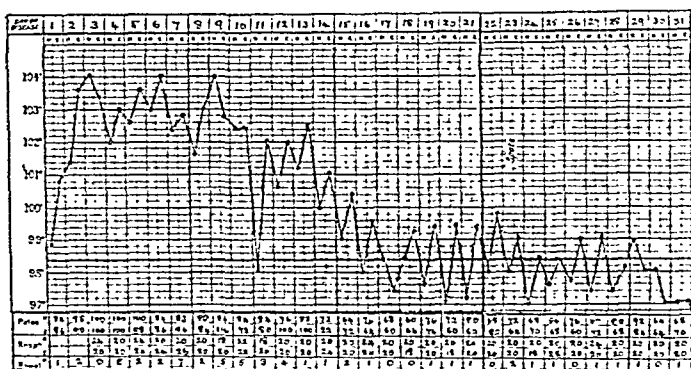


Chart 5. Para. B.

possible to estimate the extent of this increase, because, as far as can be ascertained, the paratyphoid infection is capable of causing a febrile period of over 30 days, unaided by secondary infections.

TYPE B. 27.5
per cent.
(Charts 5, 6.)

This type was characterized by slight evening fever which persisted after lysis, the average height reached being 99.3 F. and the average duration,

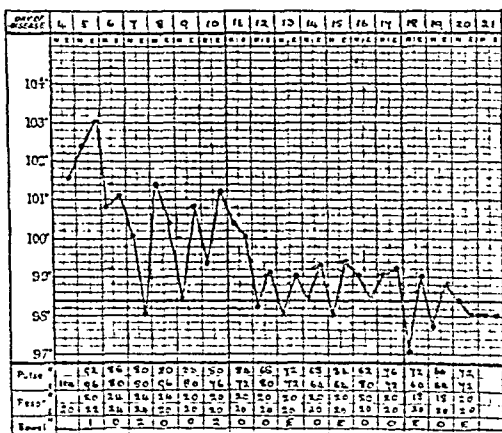


Chart 6. Para. A.

7.6 days. In two cases this continued for 17 days. The initial febrile period was similar to that of type A., except that the average duration, 17 days, was three days

which variations are common.

Course of Fastigium and Defervescence.—A study of the course of the fever shows the existence of four main types.

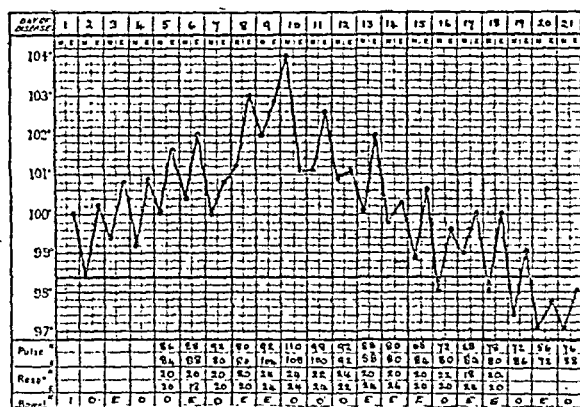


Chart 4. Para. B.

complications. Complications may prolong the fever of any type, but do not create the type itself. In any type, the fever may show a very remittent character throughout. (Chart 1.)

TYPE A. 38.9 per cent. A definite febrile period is followed by simple lysis and recovery.

This type has been outlined in the general description of the disease. (Charts 1, 2, 3, 4.) The total duration of the fever varied considerably. In two cases it was complete in six days; but in three it lasted over 30 days, the longest noted being 38 days. The average total duration of fever for all cases of this type was 14 days, made up of three days onset, six or seven days fastigium, and four or five days lysis. During the fastigium, the evening temperature reached nearly to 103° F., but morning remissions of two or more degrees occurred, and increased in extent towards the end of this period. In most cases a height of 104° F. was reached at some time during the onset or fastigium, but the day of occurrence of this peak was quite irregular. Lysis covered a period of four or five days, and was complete and final.

This type illustrates a sharp fight between infection and

These types are mentioned in some detail, because they appear to illustrate the principal variations which occur in the development of active immunity, and are not a simple product of

plications, in all cases except one, in which venous thrombosis was coincident. (Chart 8.) The type seems to show the occurrence of two or more pitched battles between infection and immunity, the latter achieving complete victory only after the second or third.

TYPE D. 8.1 per cent.
(Charts 9, 10.)

This type is a combination of types B. and C., slight evening fever persisting after lysis from an intercurrent relapse. The average height of this evening fever was $99^{\circ}.4$ F., and the average duration about a week. In this type again, no complications could be found to account for the fever, and it could only be explained in the same manner as type B.

These four types account for 94.9 per cent. of all cases. The remaining 5.1 per cent. were cases in which little or no fever was observed after admission, and if records had been available, it is probable that they would have to be included in type A.

The temperature during convalescence.—In all types, the temperature tends to

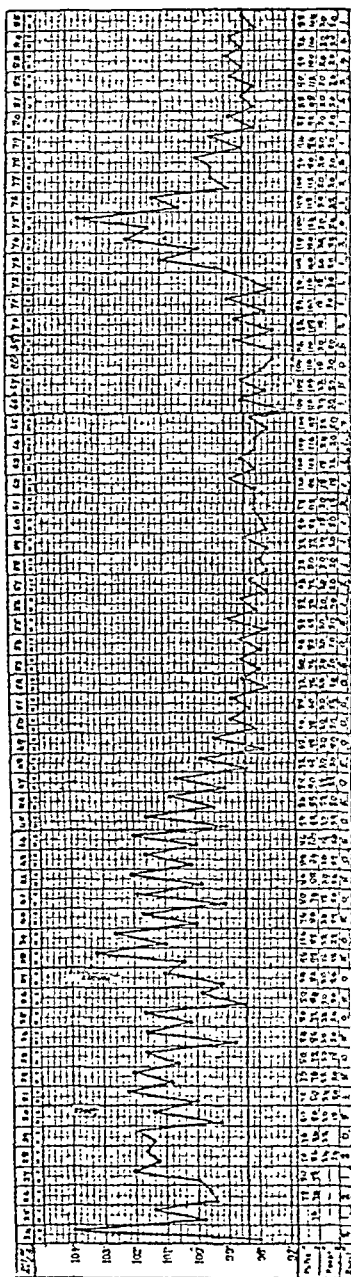


Chart 8. Para. B.

longer. Patient after patient was searched for complications which might account for this evening temperature; a small patch of pleurisy, believed to be tuberculous, was found in one, but in all others the result was negative.

In the absence of complications, this type was supposed to illustrate an incomplete victory on the part of immunity, the infection remaining capable of offering a niggling resistance, possibly by the persistence of local foci in such parts as the spleen and mesenteric glands.

TYPE C. 20.4 per cent. (Charts 7, 8, II, 12.)

In this type, intercurrent relapses interrupt the course of lysis from the initial fever, or begin after one or two days of intermittent fever following lysis. The average durations were: 17 days for the initial fever, and nine days for the intercurrent relapse. In the majority (56 per cent.), the fever of the relapse was less severe than the initial fever, and was more remittent in character. The maximum point was reached about the third day. In the remainder (44.0 per cent.), the fever of the relapse was as severe as the initial

fever, but, even in these, the recurrence of symptoms was comparatively trivial. In most cases, there was some return of headache and apathy, but not infrequently the patient stated that he felt perfectly well

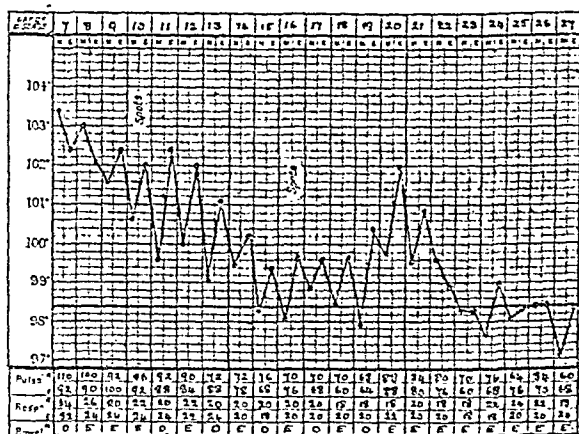


Chart 7. Para. A.

throughout. Three patients suffered from second intercurrent relapses, lasting about eight days. In these, the fever was slight in degree, and very remittent in character.

Intercurrent relapses developed quite apart from com-

plications, in all cases except one, in which venous thrombosis was coincident. (Chart 8.) The type seems to show the occurrence of two or more pitched battles between infection and immunity, the latter achieving complete victory only after the second or third.

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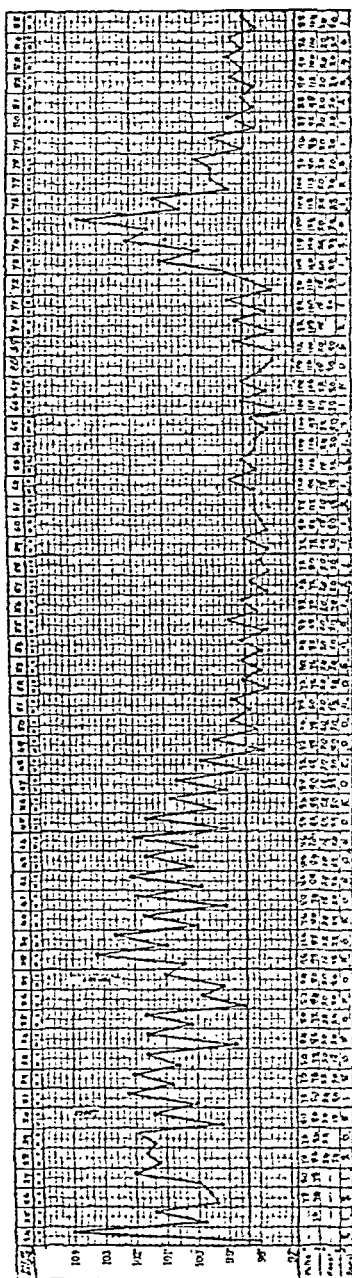


Chart 8. Para. B.

run a subnormal course (between 97° and 98° F.) during early convalescence.

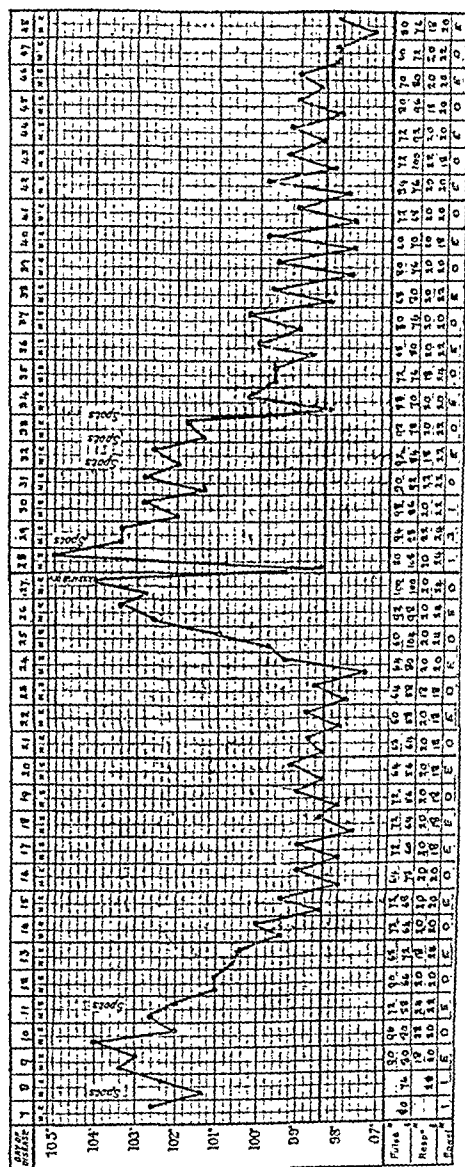


Chart 9. Para. A.

When the patient leaves his bed, a return to the normal, or even slightly above it, takes place. Constipation, excitement, or exercise, are apt to cause irregularities at any stage. In one case (Chart 2) a sudden brief outburst of fever occurred, for which no cause could be found. Similar outbursts are seen in typhoid fever, but I do not know that they have ever been explained. Possibly, in this case, a sudden general infection took place, from a previously quiescent local focus, in a subject who had developed a high degree of general immunity. The rapid rise of fever would be explained by the rapid liberation of endotoxin, which would occur in such a case; the rapid fall, by the prompt extermination of the infection.

The temperature of relapse is considered later.

SKIN.

Type and distribution of spots.—A definite skin eruption

was found in 58 cases (59·1 per cent.), spots of two distinct types occurring, either independently or mixed together.

In 26 cases, they could not be distinguished from typhoid roseolæ. In two or three of these, each spot was capped by a minute vesicle, as is sometimes seen in typhoid. In 10 cases, the eruption consisted of a mixture of roseolæ with spots, now to be described, which are more characteristic of paratyphoid fever. In the remaining 22 cases, all the spots were of this "paratyphoid" type. Each individual spot was larger than the typhoid roseola, very much more raised, and frequently lenticular in outline. The colour was a dusky red, and did not vanish completely on pressure. As it faded, slight temporary pigmentation was left, and the area showed fine branny desquamation. These spots were generally few in number, and scattered over the trunk, especially on its anterior aspect; but in some instances they were numerous, and were present on the legs and arms as well.

Stage of occurrence of eruption.—In this respect, no distinction could be made between spots of the above two types.

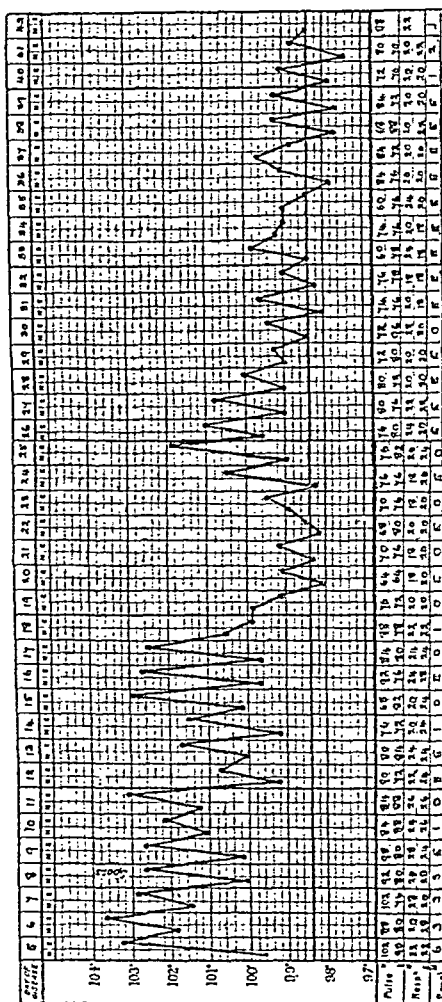


Chart 10. Para. B.

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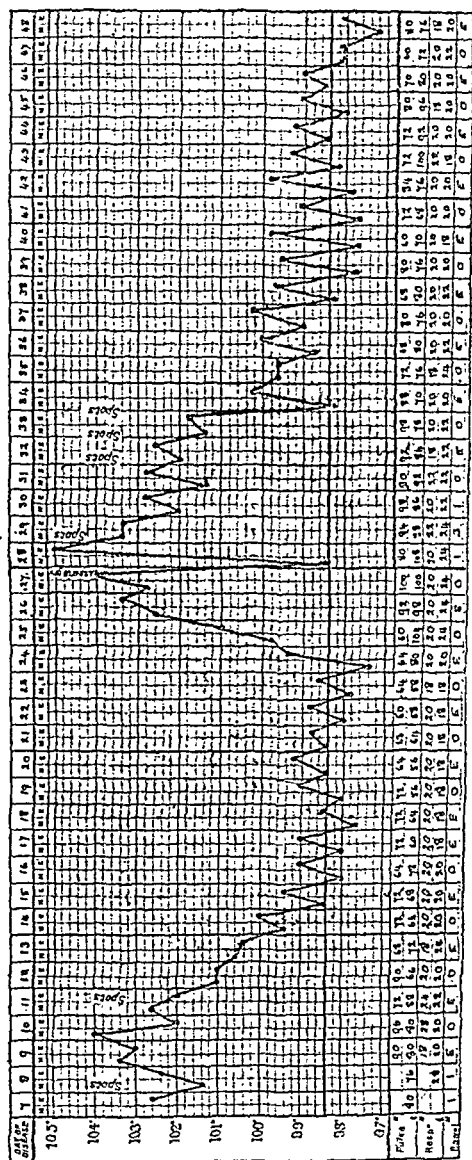


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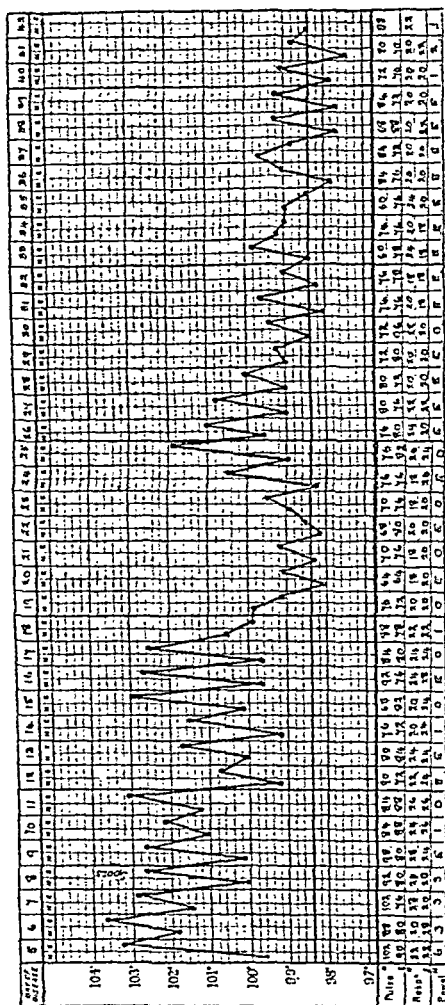


Chart 10. Para. B.

As compared with typhoid fever, both were late in appearing, for though roseolæ were seen as early as the third day, and the paratyphoid type as early as the fifth, this was exceptional, the average date of appearance for all cases being the thirteenth day of disease. In about two-thirds, they appeared during the initial febrile period, but usually within a day or two of lysis. In the remainder, they appeared during lysis, or during slight irregularities of fever following lysis.

Fresh crops of spots were found during intercurrent relapse in four cases, and during true relapse in two.

Spots of the "paratyphoid" type are not unknown in typhoid fever, but are so exceptional (about 1.0 per cent.) that their presence seems to constitute a distinct diagnostic feature in favour of paratyphoid fever, particularly when they appear as the temperature is subsiding.

Extraneous skin rashes.—These were not common. A transient patchy macular erythema was seen in four cases, and definite wheal urticaria in two. *Taches bleuâtres* were present in several cases, but this is not surprising, since all the patients were soldiers on active service.

CIRCULATORY SYSTEM.

The blood—It was not possible to examine the blood save for diagnostic purposes. Clinical observation, however, did not indicate the occurrence of marked secondary anæmia to result from the disease.

Heart and pulse.—The heart rarely gave rise to any trouble during the acute stage of the disease. Definite dilatation occurred in three cases only, and in these it was accounted for by secondary factors. One was the fatal case with empyema, the second was complicated by extensive pneumonia, and the third showed dilatation on admission, following two days' travelling in ambulances and an ambulance train. In the last two all dilatation rapidly subsided.

Simple transient hæmic bruits were heard in five cases only. Neither endocarditis nor pericarditis occurred.

In most cases (78.0 per cent.) the pulse rate was slow compared with the degree of fever, a rate of 90 corresponding roughly with a temperature of 103° F. During the acute

stages, a constantly higher pulse rate was always due to some complication, such as pneumonia; in the absence of complications, the pulse rate rose little, if at all, even in cases of very protracted fever. As regards general characters, the rhythm was regular, and the volume good. A dicrotic character could not often be made out.

During the early post-febrile period, some degree of slowing of the pulse was the rule, about half the cases showing rates of under 60 per minute, and two or three rates as low as 44 per minute. In this stage, the temporary occurrence of extra-systoles was noted in several cases, and in one they were sufficiently marked to produce symptoms.

In later convalescence, when the patients first left bed, a rapid pulse rate was as frequent and as marked as after typhoid fever. Sixty-six patients showed this rise of pulse rate on getting up, and in a few it even resulted from the slight exertion involved in sitting up and moving freely in bed. It also occurred readily with smoking, and on excitement. With the increase of rate, irregularities of rhythm and volume were prone to occur, but dilatation of the heart was not seen. With careful supervision of the amount done by the patient, the condition did not cause trouble, but in a few it was found necessary to prolong the period of complete rest in bed.

Veins.—Venous thrombosis occurred in four cases, all of paratyphoid B. The left femoral was affected in three, the right femoral in one. In all it occurred during an intercurrent relapse, the average date of appearance being the 29th day of disease.

RESPIRATORY SYSTEM.

Epistaxis.—This occurred in 20 cases (20·8 per cent.). It usually took place during the first few days of the disease, and, consequently, was only observed in a few, but it does not appear to have been severe in any case.

Sore throat was complained of by 20 patients, four stating that it had been a marked initial symptom. The condition usually found was a slight general hyperæmia and œdema of the pharynx. In one patient, a peritonsillar abscess formed during convalescence, but there was no evidence that this

was due to paratyphoid infection.

Laryngitis.—Catarrhal laryngitis occurred in four cases, during the period of maximum fever. In all it cleared completely in a few days, as the general condition of the patient improved.

Lung complications.—Definite complications affecting the lungs occurred in 66 cases (67·3 per cent.), a proportion which is probably exceptional, and partly due to the conditions of active service. Of these, 33 had slight general bronchitis, developing cough about the fourth day of disease, and yielding definite catarrhal signs a day or two later. Both signs and symptoms rapidly subsided with the commencement of lysis. In eight cases, the bronchitis became more severe, extended to the finer tubes, and was slower in resolution. Nineteen cases had broncho-pneumonia. In most of these, bronchitis started as above, but extended down and caused definite patches of consolidation. In a few, this consolidation was extensive. In five cases, the pneumonia was lobar in distribution, and in four of these dry pleural friction was present over the solid area. The fifth developed a bacillus coli empyema, which proved fatal. One patient developed a patch of dry pleurisy during convalescence, but this was considered to be tuberculous.

Sputum.—The above lung complications appeared to be due to secondary infections, the organisms commonly found in the sputum having been the pneumococcus, micrococcus catarrhalis, streptococcus, and bacillus influenzae.

ALIMENTARY SYSTEM.

As in typhoid fever, anorexia and thirst occur in the early stages, and hunger during convalescence.

Tongue and mouth.—There is no typical "paratyphoid" tongue, as is seen by the following list: tongue moist throughout, with very slight white fur, 22·6 per cent.; moist, but covered with thick white or yellow fur, 32·8 per cent.; dry, covered with white or yellow fur, 26·7 per cent.; dry, covered with brown fur, 7·2 per cent.; dry, with central brown strip and clean edges, 8·2 per cent. As a rule, the tongue cleaned with lysis, but, in some cases, it remained dirty when all other signs and symptoms had subsided, and in these it appeared to present a suggestive diagnostic point.

Dental caries and pyorrhœa alveolaris were common, as would be expected among soldiers on active service, but parotitis and other mouth complications were not seen, a fact which must be placed to the credit of the nursing staff.

Diarrhœa.—In six cases only were the bowels regular throughout the disease. According to the histories given, diarrhœa occurred in 61 (62·2 per cent.), always during the early febrile stage. Twenty-seven patients stated that it formed a prominent symptom of onset, and 41 that it started on the first day of disease. One or two patients stated that the stools had contained blood at the start, but this was never observed. When present under observation, the diarrhœa was found to consist of the passage of from four to six loose motions in the 24 hours, and, though many reported it to have been more severe at first, palliative treatment was rarely necessary. The stools were composed of simple loose unformed faecal material, and were brown in colour. The light "pea soup" stool of typhoid fever was not often seen. In a few severe cases, the stools were offensive, containing undigested milk curd and excess of mucus, but this was easily controlled by appropriate treatment. No trace of hæmorrhage was ever seen, though every stool was inspected for it.

Constipation.—Seventy-four cases (75·5 per cent.) showed constipation at some stage. In eight, it was present from the start, but in most it followed directly after diarrhœa, and persisted until the patient got on to full diet and left his bed. The average duration for all cases was 17·9 days. Simple enemata were found satisfactory in relieving it, especially when aided by administration of liquid paraffin.

Vomiting.—Considering the degree of intestinal upset and fever present in most cases, vomiting was not a common symptom. It occurred in 18 cases only—in all, during the acute stage—and was never marked or repeated.

Abdomen.—As would be expected from the above, few patients passed through the disease without abdominal discomfort, but in about a quarter (27 cases) this did not amount to pain. In the remainder, some form of abdominal pain was experienced, and though it was rarely severe, it formed a prominent symptom of onset in 21. It was difficult to get good descriptions of the character of the pain,

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to the right side of the abdomen, but a diagnosis of cholecystitis could never be made. This does not, however, negative the possibility that infection of the gall bladder may be frequent. Mr. J. E. H. Roberts told me of an interesting case, in which he had removed a large gall-stone from a youth who had suffered from an indefinite febrile illness some six weeks before. On examination, the gall-stone was found to contain pure paratyphoid A. The inference regarding the indefinite febrile illness is obvious.

NERVOUS SYSTEM.

Headache.—This was the most frequent and constant of all symptoms, being present in 88 cases, and absent in 10 only. When present, it almost always (92·5 per cent.) started on the first day of disease. The average duration for 80 cases was 10·5 days, but, in this respect marked variation was seen. In some, in common with other symptoms, all headache vanished completely long before the temperature settled, whereas in others it persisted for some time after defervescence. In either event, such independence of the fever displayed by the headache, seemed a rather suggestive diagnostic point.

The frontal region was the site of election. Thus, among 66 cases, the position of the headache was found to be as follows: frontal only, 41; frontal and occipital, 9; general, but most intense in frontal region, 6; occipital only, 4; general, 6.

The severity of the pain varied in different cases. In some, the pain was slight; in most it was fairly severe at some stage, and, in a few, it was very intense and called for palliative treatment. When severe it was usually described by the patient as a hard boring pain, extending from temple to temple at the back of, and above, the eyes. Considering the situation and intensity of the headache, photophobia was not a marked symptom.

In a few cases, particularly those with marked occipital headache in addition to muscle pain in the neck, the question of meningitis was considered, but in no case were any further signs or symptoms of this disease found. Lumbar puncture was performed on one occasion, normal fluid being obtained.

Mental condition.—True delirium was very rare, even in

but it appeared that 31 suffered from definite intestinal colic during the early stages of diarrhœa, 10 had local pain combined with colic, 26 local pain only, and four generalized abdominal pain which they could not describe at all. Local pain occurred in any position, but was most frequently referred to the two iliac fossæ, and the left subcostal region. It was usually accompanied by local tenderness, but not by true local rigidity. When present in the left subcostal region, it was thought to be related to the spleen, and in three patients who suffered from brief attacks of acute pain in this region, a diagnosis of perisplenitis was made.

On examination, the abdomen was noted as normal in 15 cases, but it is probable that this number would have been reduced if all cases had been examined in the earliest stages of the disease. It was usual to find a slightly tumid abdomen, elastic and firm to the hand, but not really rigid, deep palpation being possible, even in an area of local pain, provided pressure was applied gradually, and the attention of the patient distracted at the same time. Sixty-three cases showed this tumidity due to tympanitic distension, and 64 complained of tenderness, local or general. General borborygmi was common, and a local cæcal gurgle was felt in 19 cases.

Spleen.—In 67 cases, no sign of enlargement of the spleen could be demonstrated, but this does not negative the probability that some enlargement is constant. In 22, the edge of the organ became definitely palpable, and in 9, though the edge could not be felt, definite increase in splenic dulness was found. When palpable, the edge was found to be little if at all tender. Pain in the splenic region could not be proved to arise in connection with this organ itself, but this seemed to be the most likely explanation. The three cases, in which perisplenitis was diagnosed, would be very difficult to account for on any other assumption.

Liver and gall-bladder.—Symptoms and signs connected with the liver and gall-bladder were very rare, occurring in one case only. In this case, transient jaundice, with slight enlargement of the liver, occurred, during the early stage of the disease, both subsiding before the end of the febrile period. Special attention was paid to the gall-bladder in all cases with persistent fever, or in which pain was referred

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but it appeared that 31 suffered from definite intestinal colic during the early stages of diarrhoea, 10 had local pain combined with colic, 26 local pain only, and four generalized abdominal pain which they could not describe at all. Local pain occurred in any position, but was most frequently referred to the two iliac fossæ, and the left subcostal region. It was usually accompanied by local tenderness, but not by true local rigidity. When present in the left subcostal region, it was thought to be related to the spleen, and in three patients who suffered from brief attacks of acute pain in this region, a diagnosis of perisplenitis was made.

On examination, the abdomen was noted as normal in 15 cases, but it is probable that this number would have been reduced if all cases had been examined in the earliest stages of the disease. It was usual to find a slightly tumid abdomen, elastic and firm to the hand, but not really rigid, deep palpation being possible, even in an area of local pain, provided pressure was applied gradually, and the attention of the patient distracted at the same time. Sixty-three cases showed this tumidity due to tympanitic distension, and 64 complained of tenderness, local or general. General borborygmi was common, and a local cæcal gurgle was felt in 19 cases.

Spleen.—In 67 cases, no sign of enlargement of the spleen could be demonstrated, but this does not negative the probability that some enlargement is constant. In 22, the edge of the organ became definitely palpable, and in 9, though the edge could not be felt, definite increase in splenic dulness was found. When palpable, the edge was found to be little if at all tender. Pain in the splenic region could not be proved to arise in connection with this organ itself, but this seemed to be the most likely explanation. The three cases, in which perisplenitis was diagnosed, would be very difficult to account for on any other assumption.

Liver and gall-bladder.—Symptoms and signs connected with the liver and gall-bladder were very rare, occurring in one case only. In this case, transient jaundice, with slight enlargement of the liver, occurred, during the early stage of the disease, both subsiding before the end of the febrile period. Special attention was paid to the gall-bladder in all cases with persistent fever, or in which pain was referred

The muscles of the legs and lumbar region were usually affected, but no part of the body was exempt. Save for very slight tenderness on deep palpation, physical signs were absent. In a few instances, the posterior cervical muscles were involved to such a degree that the question of meningitis was considered, but in these true muscle rigidity was absent, and other signs did not support the suspicion. In other instances, the pain in the leg muscles was so severe that neuritis was suspected, but this, again, was never confirmed by physical signs. As a rule, the muscle pain subsided gradually with defervescence, but in some cases the correspondence with temperature was not so exact. Treatment was always found most disappointing, drugs and local applications giving but slight relief.

During late convalescence, a few patients complained of painful feet, but this symptom was neither as frequent nor as marked as in typhoid fever.

Arthralgia.—In 14 cases, muscle pain was accompanied by pain in the joints, and in two, pain was limited to the joints. The knees and ankles were most frequently affected, sometimes the hips, shoulders, elbows, and wrists, and, in one severe and protracted case, the right sternoclavicular joint. In some, the pain was nearly as severe as that of rheumatic fever, and resembled it in a tendency to shift from joint to joint. It was, however, always referred by the patient to "deep in the joint," and, with the single exception of the sternoclavicular joint mentioned above, in which slight swelling occurred, physical examination was negative, except for very slight tenderness on deep palpation. As a rule, joint pain subsided with lysis, but, in two severe cases, it persisted for weeks with slight irregular fever. As in the case of myalgia, treatment seemed to have but little effect.

Both muscle and joint pains may occur in typhoid fever, but, on the whole, are so much less severe, less frequent, and less persistent, that, when present to a marked degree, they help to suggest the diagnosis of paratyphoid fever.

Periostitis.—This occurred in one case of paratyphoid B., starting during convalescence, and affecting the axillary portion of the eighth rib on the right side. After causing the usual local signs and symptoms, with slight fever lasting

severe cases. One patient was watched for two nights for fear he would get out of bed, but the precaution was found to have been unnecessary. In eight cases, quiet mental confusion was present, untrue or inconsequential answers being given to questions; but the usual mental condition was one of apathy, in which questions were answered correctly, but not without obvious mental effort. The typhoid state was not seen. This comparative absence of delirium is the more striking, in view of the fact that almost all of these patients had only just left the firing line, one or two having recent wounds, and others having been exposed to gas poisoning.

Special senses, etc.—In many cases, as in typhoid fever, slight deafness was noted to develop during the acute febrile period. Except for this, affections of the special senses did not occur. No organic nerve lesions, or postfebrile psychoses were seen.

GENITO-URINARY SYSTEM.

The urine was examined in many cases, though this could not be done as a routine in all. During the febrile stages, the usual febrile characters were found. Kidney and bladder complications were very rare. In many cases, in which no cause could be found for protracted fever, the urine was examined carefully for possible renal complications, always with negative result. One case only, of paratyphoid B., had a brief temporary outburst of acute nephritis, occurring during convalescence from a slight attack. The temperature was raised to about 100° F. for two days, and the urine presented the usual characters of acute nephritis, but was sterile. After a fortnight of careful dieting, the condition cleared completely.

A tendency to retention of urine occurred in four or five cases, but occasional catheterization was required in two only.

MUSCLES, JOINTS, AND BONES.

Myalgia.—In 55 cases (56·1 per cent.), muscle pains were complained of during the early stages of the disease, and, in 23, they formed a prominent symptom of onset. In several, they were so intense during the acute stage as to interfere with sleep night after night. The pain was increased by movement, but constant as a steady ache when at rest.

duration of the initial febrile period and of intercurrent relapses; the more moist character, and less marked furring of the tongue; the different character of the spots, and their occurrence when other symptoms and signs are improving; the darker character of the stools; the greater frequency of joint and muscle pains.

Diagnosis from influenza.—With care, this is more easy. Points which favour paratyphoid fever are: the more gradual onset of symptoms and ascent of fever; the absence of coryza; the rarity of rigors; the absence of early cough; the gradual onset of prostration, and its mild character compared with the degree of fever; the occurrence of diarrhoea; abdominal tumidity; the absence of signs of cardiac embarrassment during the febrile stage; the absence of post-febrile psychoses and affections of special sense.

It is well to remember that influenza bacilli may be present as the cause of pneumonia complicating paratyphoid fever; and, further, that a patient with a temperature under 100° F., and almost free from symptoms, may still be in a condition of paratyphoid septicæmia, and yield a growth of that organism on blood culture.

PROGNOSIS.

A mortality of 1·02 per cent. only, and that among soldiers on active service, shows that the prognosis is very good. It is true that many of the patients became seriously ill, particularly those with pneumonia, but, just when they had reached a condition in which, in typhoid fever, a real struggle for life would have commenced, they always turned the corner, and started to improve rapidly. To express it in another way, stimulants had to be given to many, but, with the single exception of the fatal case, it was never necessary to push them.

It is impossible to predicate the duration of fever in any case, the course of development of immunity being capricious, and, in the absence of a good strain of vaccine, apparently beyond control.

TREATMENT.

A: Prophylaxis.—Prophylactic measures should be carried out in exactly the same way as for typhoid fever. The most difficult and anxious point in this connection is to prevent

three days, it rapidly subsided.

RELAPSE.

True relapses occurred in seven cases, all of paratyphoid B. The charts show an acute "steppage" onset, the maximum point being reached on the third day, after which defervescence began at once. The average total duration was 8.5 days. Symptoms recurred in these relapses, but usually to a slight extent only. Fresh spots were seen in two cases, but apart from this the physical signs were merely those common to high fever.

One case, not included among the above, needs special mention. The initial febrile period ran an usual course of 15 days. Blood culture was negative, but the clinical diagnosis was confirmed by the isolation of paratyphoid B. from the faeces, and, further, by a rising Widal reaction to that organism. After 12 days of normal temperature, what appeared to be an ordinary true relapse occurred, lasting 15 days. A blood culture taken in this relapse grew pure paratyphoid A., strongly suggesting that the patient had been infected while under treatment for paratyphoid B.

DIFFERENTIAL DIAGNOSIS.

Points which help to distinguish typhoid fever from diseases such as miliary tubercle, cerebro-spinal meningitis, pyæmia, and acute pneumonia, also hold good for paratyphoid fever. Much greater difficulty is experienced in distinguishing some cases from typhoid fever, and others from influenza.

Diagnosis from typhoid fever.—At first, it appeared to be out of the question to make a differential diagnosis on clinical grounds alone, especially during the early stages; but, with increasing experience, it was found possible to give a fairly sound opinion on this point, though never with such certainty that bacteriological examination could be excluded. To translate this experience into words is beyond my power, but the following points may be cited as in favour of paratyphoid: the absence, or mild character, of nervous symptoms, with the single exception of headache; diminution or cessation of headache without decrease of fever, or conversely, the persistence of headache after defervescence; the earlier occurrence of marked remissions of fever; the shorter

should consist of 500 millions, subsequent doses being increased by a regular increment of 500 millions. An interval

of three days should be given between doses. As in typhoid fever,* care must be used in dosage if lung complications are present, and, in this case, a vaccine suitable to combat the secondary infection may with advantage be combined with the paratyphoid vaccine.

Diet. —

The absence of the mechanical catastrophes of perforation and hæmorrhage, might be used as an

argument against a rigid limitation of diet, as practised by most in the treatment of typhoid fever; but this absence does

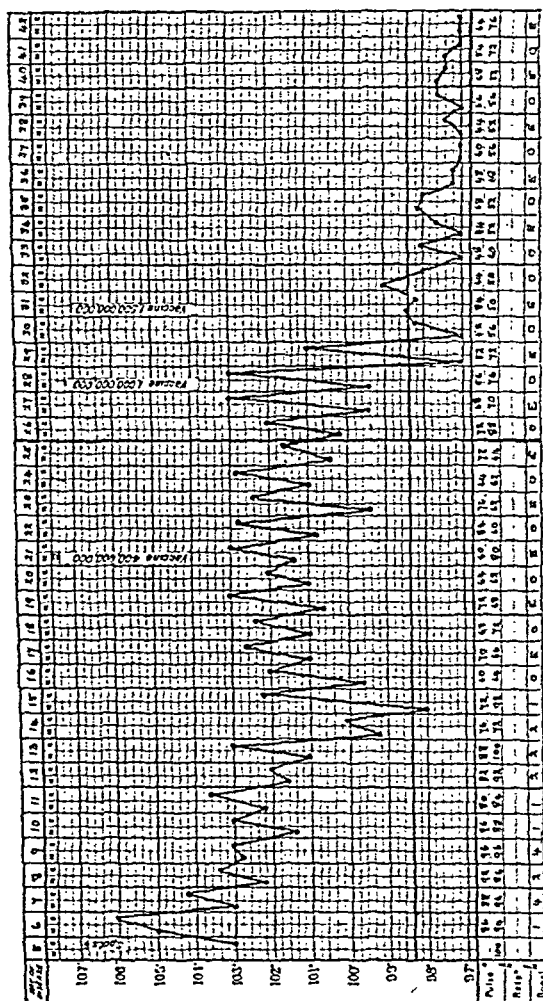


Chart 11. Para. B.

* Wiltshire and Macgillicuddy: "Experiences in the Treatment of Typhoid Fever by Stock Typhoid Vaccine," *Lancet*, September 25, 1915.

the escape of the mild case, owing to failure in diagnosis.

B: Therapeutics.—Only a few special points need be considered here, the general management and treatment being the same as for typhoid fever.

Hexamine was tried as a method of direct attack on the infecting agent. Doses of one drachm were given three times a day, but, in spite of this large dosage, it cannot be said that the least benefit resulted in any case. Although the drug was given with plenty of water, it caused slight renal irritation in one or two cases, but this promptly ceased when the drug was stopped. It may be, as suggested by Sir Berkeley Moynihan, that the use of hexamine may lessen the probability of the subsequent formation of gall stones, but it is evidently ineffectual in the immediate treatment of the disease.

Quinine.—Quinine was given in several instances, in doses of ten grains every eight hours. In cases with high fever, it was found to exert a slight antipyretic action without causing depression, but it had no further effect. As in typhoid fever, however, it seems worth a trial in cases which give a history of malarial taint.

Vaccines.—Vaccines prepared by Captain Just received a fairly extensive trial, in both forms of paratyphoid fever, and the result may be summed up by saying that all depends upon the particular brew of vaccine employed. Excellent results were obtained with the first stock prepared (Charts 11, 12.) When this was finished, another stock was made in the same manner, consisting of descendants of the same original strain, but this preparation gave most doubtful results. Of 25 cases treated with the first stock, the result was definitely good in 21, and doubtful in 4, it being impossible in the latter to state that the improvement seen would not have taken place equally if the vaccine had not been given. Seventeen cases were treated with the second stock, the result being good in six cases (though not so good as those treated with the first vaccine), doubtful in eight, and doubtful harm in three.

The action of the first stock was quite sufficient to show that a good strain of vaccine is by far the best agent we possess for the treatment of the disease, and the only one by which we can hope to shorten its course. The first injection

complications. Apart from these, only isolated doses were required to meet some special factor. Brandy was found the most satisfactory form of stimulant to use. In two cases, injections of digitalin (gr. $\frac{1}{100}$) were given, but (as was also the case in typhoid fever) this drug was found to do more harm than good. Strychnine was not used during the acute stage, but during convalescence it was given to almost every case, for its tonic action on the myocardium and sluggish intestinal muscle.

Constipation.—Simple soap enemata were employed as the routine treatment during the stage of constipation, their action being assisted by the addition of prunes to the diet, and the administration of strychnine during convalescence. In many cases, liquid paraffin was given as well, and it was found that very few patients objected to it. The enemata were given by orderlies, and, on several occasions, were found inefficacious, unless preceded by injections of warm olive oil. The impression remains, however, that a simple enema should always be sufficient, provided that it is skilfully administered.

Many patients had received doses of purgatives before admission, usually in the form of pills or castor oil. It cannot be said that either good or harm resulted, except for the slightly constipating after-effect of the oil. At one time, small doses of mist. alba were given in the early stages, with the idea that the resultant stools might be more favourable for bacteriological investigation. Neither harm nor good to patient or bacteriologist resulted, and so the practice was discontinued.

Mouth toilet.—It was exceptional to find a clean mouth among these patients, almost all having extensive dental caries, and many some degree of pyorrhœa alveolaris. After every feed the mouth was thoroughly swabbed out with carbolic glycerine, or, if the patient was fit, a mouth wash was used. The latter acts best when alkaline, and capable of dissolving and loosening the tenacious ropy mucus which clings to the mucous membrane in these cases. The following formula was found to answer well:—

R	Sodii benzoatis	-	-	-	-	-	gr. x.
	Sodii bicarb.	-	-	-	-	-	gr. xv.
	Sodii biboratis	-	-	-	-	-	gr. x.
	Glycerini	-	-	-	-	-	℥i. xv.
	Aquæ	-	-	-	-	-	℥i.

not constitute a reason why a patient, with an inflamed and atonic intestine, should be given more than he can digest. In practice, it was found that digestive capacity lagged behind appetite, and that patients did best when dieted in the same way as those with typhoid fever.

Three pints of milk, one pint of beef tea, and two ounces of milk chocolate, formed the routine diet during the acute stage of the disease. The amount of beef tea was varied according to the condition of the bowels, and, when con-

stipation was present, about four ounces of mashed prunes were added to the dietary. Calves' foot jelly, milk jellies, junket, and milk tea, were allowed as variants at any stage.

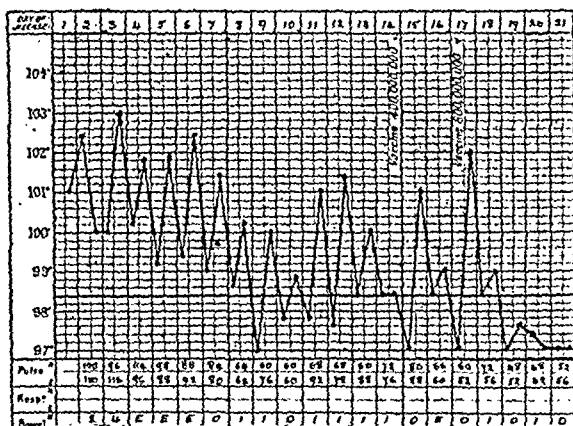


Chart 12.

The occurrence of frequent offensive stools, containing undigested milk curd, was checked by limitation of diet to albumen water, or whey, for a few feeds, and the simultaneous administration of a few doses of bismuth and salol.

After five days of normal temperature, custard or two egg flips were added to the diet; after 10 days, fish and a small quantity of bread and butter; and after 15 days, a full chicken diet was allowed.

This diet was found ample to maintain nutrition, the patients starting to gain flesh as soon as the temperature approximated the normal line; and, though many complained of hunger during the early stages of convalescence, a more rapid increase in the amount allowed was not well tolerated.

Stimulants.—Stimulation was necessary in several cases for a brief period after admission, in order to neutralize the effects of a journey, and, in most cases, with marked lung

Diarrhœa may be admitted on question only, and the usual administration of two pills by the regimental medical officer, one of the facts most impressed upon the patient's memory, offers a plausible explanation of this, unless dates are carefully investigated. On admission, or within a few hours, the temperature may be normal, and the signs merely those of general debility. The medical officer cannot be blamed for filling in the diagnosis as influenza, and, unless a relapse should occur, remaining satisfied therewith. One more potential paratyphoid carrier is thus set free.

Any figures in this connection can only be conjectural at the best, but it seems probable that about 25 per cent. of cases may be missed in this way, never being subjected to the careful investigation which follows suspicion of the "enteric group."

POSTSCRIPT.

Since this article was written, a paper dealing with the subject has been published by Dr. Henry Robinson (*Lancet*, October, 16, p. 851). As was the case with him, the literature was not available at the time my cases were under treatment and has since been avoided, so that our papers are not only independent, but both are also free from prejudice.

The differences between our experiences are few, and probably capable of easy explanation. Two points of difference may be briefly referred to here:—

(1) *Diagnosis*.—Dr. Robinson does not state the total number of cases in which blood culture was done, but mentions that a positive result was obtained in one case only, which would be 2.1 per cent. of his diagnosed cases. In my series blood culture was done in 94 cases, with a positive result in 36.38.9 per cent. This difference may have been due to the methods used, Captain Just always having taken at least 5 cc. of blood and used pure ox bile as the culture medium. I am hoping that Captain Just will publish his experiences on this important point.

(2) *Lung complications*.—These appear to have been much more frequent and severe in my cases. Dr. Robinson implies that his cases occurred in the summer, whereas most of mine occurred between January and May, when the weather was most unfavourable. My cases were all in tents, which I considered to increase the tendency to lung complications in the bad weather. In one case only could the lung complication be accounted for by previous gas poisoning.



The administration of plain milk chocolate was of considerable service, stimulating the secretion of saliva, and giving the tongue and mouth a good mechanical wash. A similar action was promoted by the use of chewing gum. Most forms of chewing gum are highly flavoured, and promote a profuse secretion of saliva. At the same time they stimulate prolonged quiet chewing, and the gentle mechanical friction thus induced, takes the place of the normal mastication of solid food in cleansing the mouth. In the case of a febrile illness like paratyphoid fever, the use of chewing gum will not cleanse the tongue completely, as it will, for instance, the tongue of a hæmatemesis patient being fed by nutrient enemata; but it is of very great assistance, pleasant to the patients, and saving of much work on the part of the nursing staff.

Hyperpyrexia.—It is rare for a patient with paratyphoid fever to pass through the disease without having a temperature of over 103° F. at some stage, but it is also rare for this temperature to persist for more than a few hours. High temperature can always be reduced by simple tepid sponging, when skilfully applied, and it was never found necessary to have recourse to other measures.

Muscle and joint pains.—Aspirin and other forms of salicylate were found practically useless to relieve these pains, but usually produced very profuse sweating and a sudden temporary fall of temperature (Chart 9). The local application of heat or liniments gave very slight relief. The best palliative result was obtained by giving a mixture of phenazone and bromides, but even this did not effect much.

CONCLUSION.

In conclusion, the main question which forces itself upon the mind concerns the proportion presented by cases of paratyphoid fever actually diagnosed to the total number of cases occurring. The suspicion that many mild cases escape under the cloak of influenza is strong, whether applied to military or civil practice.

Take the not uncommon case of a man who reports sick about the fourth day of disease, and arrives at the base hospital about the eighth day. He will give a confused history of headache, malaise, and pain in the back and limbs.

and the time in hospital is very considerably curtailed, as compared with other methods.

The effect of ichthyol on a wound with thickened unhealthy edges has to be seen to be appreciated; the edges appear simply to melt away.

All my patients have invariably volunteered the statement, that this treatment suited their wounds better than anything that had previously been applied, either at the Front or in this country.

The ordinary methods used in surgery must be applied; necrosed bone, bullets, pieces of clothing, etc., should be removed, abscess cavities opened to their full extent, and counter openings made where sinuses are present, when this is practicable.

The method of application to the wound is by means of a camel-hair brush; I paint the surrounding skin, as well as the whole surface of the wound, or apply it on lint or gauze.

On changing the dressing, I avoid washing the surface of the wound with lotion; I dry the surface with a small swab of cotton wool, and occasionally dab the surface with pure Spiritus Vini Rectificati, for I believe the drier the wound is kept the quicker the healing process. The dressing may adhere to the edges of the wound; to detach it, I use freshly-boiled water instead of any of the ordinary antiseptics, which I have entirely discarded.

Many of the wounded come to my hospital with drainage tubes; these I remove at the first dressing and never replace them—they are unnecessary and cause much suffering.

I syringe out sinuses with pure Spiritus Vini Rectificati; when patients complain of irritation from the spirit, I employ an alcoholic solution of Methylene Blue (4 grs. to 3j.); precipitation results where it comes in contact with the ichthyol, but this does not appear to delay healing.

It is not necessary to remove the ichthyol from the skin at each dressing.

This treatment can be used for any kind of wound.

THE TREATMENT OF SEPTIC WOUNDS WITH EQUAL PARTS OF ICHTHYOL AND GLYCERINE.

By C. W. DUGGAN, M.B., C.M., MAJOR R.A.M.C.

Surgeon to the Military Hospital, Lincoln.

I AM not aware of any literature on this subject; if there is, I have not been able to consult it, and the conclusions arrived at are based entirely on my results in the Military Hospital, Lincoln.

Some four years ago, my attention was directed to the value of ichthyol in a very obstinate case of ulceration of leg, which resisted other means of treatment. After nearly a year's trial of various applications in the Military Hospitals of York and Lincoln, a complete cure was obtained in a few weeks by the daily application of pure ichthyol.

I advocate its combination with glycerine to lessen expense; glycerine is a more satisfactory base than lanolin or vaseline.

Having read of the failure of strong antiseptics at the Front, I decided to obtain cases of septic gunshot wounds from the Lincoln Territorial Hospital, and, for a beginning, nine of the worst septic cases were selected from about 800 patients. I have kept a careful record of these nine cases, and have no hesitation in stating that, in two, the patients' limbs were saved from amputation by this combination; in two, two circular wounds, each 5 in. across, healed over in five weeks without skin grafting. These, and all my other cases, have done exceedingly well, and quite justify the great importance I attach to ichthyol in the treatment of septic wounds.

The advantages I claim for ichthyol are: There is practically no irritation of the wound; the dressing does not adhere to the surface of the wound, it need only be changed once in 24 hours—in very extensive septic wounds, not more than twice in 24 hours; there is a great saving in cotton wool, lint, and bandages; the strain in nursing is lessened; the patient is no longer disturbed by frequent dressing,

boys overstated their age and broke down under strenuous training, solely because of their immaturity. Others concealed disabilities which had frequently rendered them *hors de combat* in civil life, but which were not evident on a superficial examination.

A great number, I regret to say, were not properly examined in the hurry and excitement of the crisis, and thus many obvious and disabling complaints were overlooked. The regimental surgeon posted to a battalion thus found himself confronted with hernia, extreme degrees of defective sight, cardiac disease, bad varix, old injuries, deafness, and even mental deficiency.

In the first flush of patriotism, many men were carried away by a form of military hysteria and the actions of their neighbours and friends, and joined the colours, but were by temperament unsuited to the life. These, after several months of severe training, tired and became "fed up," so that an epidemic of malingering set in with "discharge as medically unfit" as the end in view. They reported sick on every possible occasion, and always on divisional, brigade, and route march days, and, if sent to duty, promptly fell out half a mile from home. Ordered to report to the medical officer, and again put on duty, they went to bed and declared their inability to get up, and the medical officer had to report them for going sick without cause, with the uneasy feeling at the back of his mind that he himself might be mistaken.

Even the keen soldier became subject to this complaint, if the training were long and the prospect of going abroad seemed remote.

The leakage became so serious that a new standard was instituted, and discharge rightly became as difficult as it had been easy; consequently, no man was lost to the service of his country, who could be made use of. Home service, garrison duty, and light duties absorbed large numbers who could undertake such, and the "rot" was stayed, to the advantage of all concerned.

Writing as a Territorial officer, my remarks apply mostly to Territorial matters.

A few remarks on the nature of the disabilities I have met with during the past 14 months regimentally, in charge of hospitals and as a member of medical boards, may be

"MEDICALLY UNFIT."

By HENRY WAITE, M.R.C.S., MAJOR R.A.M.C. (T.).

Medical Officer in Charge, Northern Signal Companies Corps, Royal Engineers (T.), etc.

IN the early stages of the present war, before we had realized what we were up against, the number of recruits rejected, and the number of men discharged on account of medical unfitness, was as appalling as it was, in hundreds of cases, unnecessary. This was not entirely the fault of medical examiners, who worked according to certain standards, varying from time to time, but because these rules for medical examination were incapable of any degree of elasticity. Men were either fit for active service or unfit, and there was at that time no *via media*. Even with these directions in front of him, the standard varied with the examiner, which, particularly if he were a Territorial or civilian, ranged from undue severity to appalling laxness.

I admit freely that the severity was mostly on the side of the regular R.A.M.C. officer, and that the Territorial or civil examiner was handicapped at first by inexperience of the particular disabilities that render a man unfit for military service. The desire not to decimate the unit, particularly of its N.C.O.'s, who were its backbone, and amongst whom the largest number were to be found suffering from the complaints of their seniority—bad teeth, varix, defective vision, etc.—and the necessity of passing men into the technical corps who, because of their special knowledge and training, were indispensable, led to many men being accepted who were unfit, if judged by strict army standards. Without these officers and men, some units, such as signal companies, where the work is largely that of the specialist and cannot be learnt in a few weeks, would have been washed out as far as efficiency goes.

Another reason why so many men proved unfit and kept medical boards busy all over the country was the fact that, on mobilization, Territorials were assumed to be for home defence, and a lower standard was admissible. Many young

boys overstated their age and broke down under strenuous training, solely because of their immaturity. Others concealed disabilities which had frequently rendered them *hors de combat* in civil life, but which were not evident on a superficial examination.

A great number, I regret to say, were not properly examined in the hurry and excitement of the crisis, and thus many obvious and disabling complaints were overlooked. The regimental surgeon posted to a battalion thus found himself confronted with hernia, extreme degrees of defective sight, cardiac disease, bad varix, old injuries, deafness, and even mental deficiency.

In the first flush of patriotism, many men were carried away by a form of military hysteria and the actions of their neighbours and friends, and joined the colours, but were by temperament unsuited to the life. These, after several months of severe training, tired and became "fed up," so that an epidemic of malingering set in with "discharge as medically unfit" as the end in view. They reported sick on every possible occasion, and always on divisional, brigade, and route march days, and, if sent to duty, promptly fell out half a mile from home. Ordered to report to the medical officer, and again put on duty, they went to bed and declared their inability to get up, and the medical officer had to report them for going sick without cause, with the uneasy feeling at the back of his mind that he himself might be mistaken.

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Writing as a Territorial officer, my remarks apply mostly to Territorial matters.

A few remarks on the nature of the disabilities I have met with during the past 14 months regimentally, in charge of hospitals and as a member of medical boards, may be

interesting, and perhaps a little instructive, to medical men called upon in the present emergency to act as medical examiners without previous military experience.

The medical examiner, when face to face with a defect, should ask himself, in the *first* place, "Is this a disability which is remediable or irremediable?"

Secondly.—"Is it of a progressive nature in the ordinary course of things, and—most important, as the enlistment, in most cases, is only for three years or the duration of the war—will the defect be likely to disable the man at an early date?" Due consideration must be given to the fact, that service during the present war is strenuous and exacting to a high degree.

Thirdly.—It is useful to know the particular branch of the service to which the candidate is likely to be posted. Men who are unfit for one branch may be quite suited for another, and many useful men have been lost to the service of the country on account of a narrow outlook on their medical fitness. Latterly, we have realized this to some extent, and, by permitting more elasticity in dealing with recruits, have saved many useful candidates from rejection.

It seems almost superfluous to insist that no man is properly examined, who has not been stripped. Had this been the rule, scores of men with obvious physical and pathological defects would not have passed into the service.

Instances of this have repeatedly come before me, and I might mention extreme spinal curvature, an unhealed empyema, wound, ankylosed joints, aggressive-looking herniæ, and gross forms of varix.

The question of carious teeth, with or without pyorrhœa, has been dealt with by the authorities at a fabulous cost to the country, but with immense benefit to the numbers accepted.

So many men, otherwise sound in wind and limb and in every way ideal fighting men, belong to a class in which attention to sound and the replacing of lost teeth is the exception rather than the rule. This is due to ignorance of the importance of such attention and reluctance to incur the expense. I am hoping that, at an early date, the experience gained during the last 12 months will result in the organization of a dental branch of the R.A.M.C.

To the outsider, it is somewhat alarming to hear of the

discharge from the army of huge numbers of men medically unfit. But it should be remembered that men may be unfit for military service, with its tax upon energy and resistance to disease far above normal, and yet may be fit for ordinary civilian life.

In civil life, if a man sets out for a long walk and gets winded, he slows up and goes easy for a while till he gets his "second wind." In marching, he must go the regulation pace, and often gamely struggles on, for, if he falls out, he gets slanged for slacking.

Of malingering pure and simple, I have not seen as high a percentage as I did in civil practice. Malingering does undoubtedly exist, but receives little encouragement in military life, for the persistent scrimshanker has such a rotten time that he often accepts the lesser evil and does his job. The medical officer has not to consider the possibility of the man "changing his doctor," or the indignation of misguided but sympathetic friends, with consequent loss of custom. Convinced after a careful examination—a careful examination is what I wish to emphasize—that a man is malingering, the surgeon can state the fact without the fear of giving always before his eyes.

A few statistics as to the actual causes of medical unfitness may be instructive. My examination of 2,374 men, of whom I have kept records, revealed the fact that rejections for active service and discharges were due to the following causes:—

1. Syphilis (Iritis, etc.)	-	2	13. Skin diseases	-	-	6
2. Flat foot	-	93	14. Albuminuria and kidney			
3. Varicocele	-	48	diseases	-	-	3
4. Defective vision	-	34	15. Over age limit	-	-	7
5. Rheumatic affections	-	39	16. Strains and sprains (per-			
6. Varicose veins	-	33	manent)	-	-	3
7. Otorrhœa and aural dis-			17. Post-operative condi-			
eases	-	19	tions (for varix, hæ-			
8. Dyspepsia and stomach			morrhoids, hernia,			
diseases	-	6	appendicitis, etc.)	-	11	
9. Bronchitis and chest dis-			18. Deformities	-	-	5
eases	-	9	19. Hæmorrhoids (severe)	-	4	
10. Tuberculosis of lungs	-	4	20. Hernia and abdominal			
11. Tuberculosis of glands,			weakness	-	-	13
bones, etc.	-	3	21. Accidents	-	-	8
12. Cardiac diseases	-	11	22. Loose cartilages	-	-	4

23. Gonorrhœal complications	1	32. Ankylosis of joints	2
24. Recurrent appendicitis	4	33. Graves's disease	1
25. Boils and abscesses (severe)	3	34. Epilepsy	2
26. Under physical standard	5	35. Post-diphtheritic paralysis	1
27. Mentally deficient	2	36. Incontinence of urine	2
28. Under age	27	37. Hemiplegia (slight)	1
29. Hammer toes	5	38. Menière's disease	1
30. Rickets and spinal curvature	1	39. Phlebitis	2
31. Empyema wound (discharging)	1	40. Blindness of one eye, (retinal atrophy)	1

This works out at about 25 per cent. of men examined, who were medically unfit *at the time of my examination*. This seems, at first sight, appalling, when you consider that all had been passed within three to six months as fit; but it does not mean that all were discharged. The 27 under age were discovered at medical inspection only, and this figure does not represent all the men under 19, either officially or unofficially, for, if the age was admitted, these lads were not put forward for examination.

The number of men with defective vision includes four who wore glasses supplied at random by spectacle dealers—not opticians—which were worse than useless. This number would be less by two-thirds under later standards permitted, and was mostly in the first 1,000 men examined. Most of my experience was gained in Highland regiments, and the noticeable absence of the effects of rickets in early life does not surprise me so much now I have lived in Scotland where the disease, I am informed by local medical practitioners, is rare.

The item of hæmorrhoids does not mean that I only came across three cases, but only three disabling cases, and the same applies to strains and sprains, etc. Other defects were remediable, and, where the man consented, were remedied, *e.g.*, hammer toes and varix (including hæmorrhoids), herniæ, etc.

The accidents included at least two which were undoubtedly self-inflicted by men who took this method of "working their ticket"—a gunshot wound of the leg and a deeply-incised bayonet wound of the thigh.

Many defects were found amongst middle-aged men passed into regiments from the National Reserve, including many old service men keen to rejoin their old units. Pneumonia was responsible for the unfitness of most of the chest cases, and

occurred chiefly as a sequela of measles in adults who had not had the disease during childhood, and who took it badly in consequence.

Venereal cases are perhaps better understood and treated by military surgeons than any other complaint, and, as the training was prolonged, the result was that very few cases of permanent unfitness occurred. Sore feet and blisters—the cause, *par excellence*, of temporary unfitness in summer-time—whilst they gave much trouble to medical officers in charge of troops and worry to commanding officers, were not the cause of medical unfitness proper, and the careful fitting of boots and suitable local treatment, soon reduced this evil to a minimum.

I had certain fixed ideas about the evils of cigarette smoking, but 15 months' duty amongst confirmed cigarette smokers has convinced me that it is rarely a cause of unfitness. It has accounted for some cases of D. A. H., but I cannot remember ever having disqualified any man for that alone. I have closely watched for any bad results from the present system of physical exercise, and believe that, *cæteris paribus*, it is very satisfactory both as to method and results. The web equipment (apart from its tendency to contract when wet) distributes the weight fairly evenly, and complaints about it are few and far between.

I should say that I found 151 men with defective teeth. I have not added these to my figures because, though I had to reject many men in the earlier months of the war, the authorities soon realized that this wastage was unnecessary, and steps were taken to deal with the leakage. Dentures, extractions, stoppings, and oral hygiene soon put a different face on the matter, and hundreds of men were saved to the service of their King and Country.

Flat feet are high up in the scale of figures, and though I began by rejecting all cases according to instructions, before I knew the men and their ability to march, later, I only turned back men who complained of pain, and who were unable to march any distance without becoming lame. Of the three stages, I found the man with the arch beginning to drop only complained if pushed; the man with his arch half down and ligaments stretching was often *hors de combat*, the man with complete flat foot could often march quite well and rarely complained.

23. Gonorrhoeal complications	1	32. Ankylosis of joints	-	2
24. Recurrent appendicitis	-	33. Graves's disease	-	1
25. Boils and abscesses	4	34. Epilepsy	-	2
(severe) - - -	3	35. Post-diphtheritic paralysis	-	1
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quence, it is irritating when applied to a wound. It is, however, possible, by a very simple method of preparation, to lessen this irritative effect of the hypochlorites without, in the least, altering their antiseptic properties. A solution of hypochlorite of soda, even when prepared with the greatest care, invariably contains free alkali. Resort is made to boric acid, not for any antiseptic action, but for neutralizing the alkaline reaction, and this plan answers extremely well.

The preparation of a solution of suitable strength for direct application to the tissues, that is, containing from 0.5 to 0.6 per cent. of hypochlorite of soda, is very easily made; 140 grammes of dry carbonate of soda, or 400 grammes of the crystallized salt, are dissolved in 10 litres of ordinary water, and to this solution are added 200 grammes of chloride of lime of good quality. The mixture is well stirred up, and, after standing for half an hour, the clear fluid is siphoned off from the precipitate of carbonate of lime, and filtered through cotton-wool. To the filtrate, 40 grammes of boric acid are added, and the solution thus obtained is ready for immediate use. It is important to add the boric acid after and not before filtration. A slight precipitate of lime salts may slowly make an appearance, but it is of no importance. The solution should not be kept for more than a week.

A stronger solution can be made by decomposing chloride of lime by carbonate of soda, in the proportion of 150 grammes of chloride of lime to 105 grammes of carbonate of soda in a litre of water. The mixture is filtered, and 20 c.c. are quickly titrated with a solution of boric acid of known strength—31 gr. to the litre—using phenolphthalein, suspended in water, as an indicator. In this way is determined the amount of solid boric acid, which must be added to the rest of the filtrate. As it is necessary to avoid using an excess of boric acid, it is better to add a little less than the calculated amount. The ordinary alcoholic solution of phenolphthalein cannot be used as the indicator, for the alcohol is at once attacked. The concentrated solution prepared in this way contains nearly 4 per cent. of hypochlorite of soda, and must be mixed with 6 parts of water for use. It can be kept for about a month without any marked decomposition. It can easily be made at very little cost by every competent chemist.

The diluted solution, prepared in accordance with the foregoing description, can be used for irrigation of, or continuous instillation into, infected wounds for more than a week without producing noticeable irritation. It possesses the useful property of helping the quick dissolution of necrosed tissue, and it has, too, some hæmostatic effect. The healing of wounds does not appear to be delayed by a prolonged use of the fluid. It is hæmolytic, and must never be injected into the veins.

The best results are obtained when the antiseptic treatment is begun a short time after the wound has been received, and if fresh solution is continually directed over its surface.

The technique of the method of using this antiseptic solution was

Practical Notes.

SOME NEW METHODS OF DRESSING WOUNDS.

Many of the surgeons engaged in attending the wounded have been making trials of new preparations for dressing wounds. Several have found the use of normal saline, isotonic sea-water, and of Ringer-Locke's fluid to give most satisfactory results.

In a communication to the Académie des Sciences, Professor Delbet gave an account of the numerous experiments he has made, based upon theoretical ideas. He has come to the conclusion that, of all the many solutions he has tried, one of magnesium chloride, 12.1 per cent., was best. For irrigating, for dressings, and for subcutaneous injections, this solution gave good results. In a purulent arthritis of the knee-joint in particular, in which the condition was so serious that amputation had been determined upon, this solution of magnesium chloride, used for irrigating, dressing, and subcutaneous injections, brought about an unlooked-for cure. This fluid, which has over ordinary antiseptics the advantage of respecting the cells, seems much better than the various artificial serums.

At exactly the same time, Rosenblith was reporting to the Academy the results of an analogous method of treatment which he has used for some time, and with which he has obtained remarkable results in the wounded. He had originally made use of magnesium chloride, in the form of a hypodermic injection, in a solution containing in each c.c. 0.25 gr. of magnesium chloride, and 0.02 gr. of sodium iodide. In chronic rheumatism and gonorrhœal arthritis, these injections had yielded interesting results. From this the idea occurred to him to make direct use of the eutrophic or histogenetic effect of this solution in the treatment of wounds. He altered its composition by leaving out the sodium iodide, and, since July, has only used a stock solution, prepared by dissolving 250 grammes of magnesium chloride in a litre of boiling water. For use, 4 tablespoonfuls of this are added to sufficient boiled water to make up to 1 litre, which is the normal solution employed at the Hôpital Janson. Experience has shown that, by using this solution for dressings, healing is obtained much more quickly by preventing the prolonged suppuration, which is one of the definite causes of non-healing in a large number of wounded.

Among these new preparations, Dakin's fluid seems likely to take a place of much importance. The details of this preparation were worked out in the chemical laboratory attached to the Rockefeller foundation—Temporary Hospital 21, at Compiègne—and were published by Dakin in the *Presse médicale*, No. 46. After experiments with a large number of antiseptic substances, Dakin made choice of the hypochlorite of soda, which has high germicidal properties, with the advantage of being the least hurtful to the tissues. The commercial product was always found to have an extremely variable composition, and contains as well free alkali and sometimes free chlorine. In conse-

in sponge tissue. When the wound is narrow, or if a large wound has narrow diverticula, these sheathed tubes are introduced along its course. In the case of fracture, the end of the tube should be in among the fragments. When the fluid is injected into a tube, it soaks into the spongy tissue instead of running away at once, and thus remains in contact with the surface of the wound. In superficial wounds, and in large wounds with crevices, plain tubes are inserted to the bottom of the wound or the crevices, and the whole is then packed with gauze. The dressing is completed by covering up the wound with a layer of non-absorbent wool, through which the tubes run. Before this is applied, it must be ascertained that the fluid runs freely from the tubes into the wound. A fresh supply of the solution is injected every hour or every two hours, but a better plan is to adopt continuous instillation.

Tuffier reported as well, to the *Académie de Médecine*, excellent results achieved by this method in the wounded from the Argonne. There is no suppuration and no smell, and a previous high temperature is brought down to normal in a couple of days, even in extensive muscular and articular comminutions.—(*Journ. de Méd. et de Chir. prat.*, November 10, 1915.)

In war wounds, it has to be taken into account that the foreign body is almost constant—splinter of shell, shrapnel, bullet, but especially pieces of clothing. In the neighbourhood of this foreign body there is produced a necrosis of the tissues, so much the more marked when there has been bruising of the deep tissues. The smell of sphacelus is noticed, but this need not be attributed to the rapid development of anærobes. It is more necrosis than gangrene. With energetic treatment, these cases can be much improved, and the necrotic smell quickly disappears.

Dupuy recently published some statistics bearing on this point. He makes use of the following technique:—

1. The wound is opened up freely without any dread of big incisions.

2. Contrary to what was the rule before the war, he does not hesitate to explore the wound thoroughly with the index finger, which alone is able to feel foreign bodies properly. Before doing so, the finger is sterilized by immersing it in tincture of iodine.

3. All foreign bodies—splinters of shells, shrapnel, bullets, and shreds of garments—are removed. Pieces of clothing are almost invariably present, and a careful search for them must always be made.

4. A drainage tube, wrapped in gauze, is introduced into the wound, and carried down to the very bottom.

5. No washing out is done, for not one of the lotions usually employed has ever prevented suppuration.

6. A dry dressing is applied, covering up the whole of the wound, but through which the drainage tube passes to the outer side. The outer end of the tube is then covered over with several layers of gauze.

7. By means of the tube, an injection is given every two hours

demonstrated before the *Académie de Médecine* by Alexis Carrel his co-workers, Dakin, Daufresne, Dehelly, and Dumas, under the title of *Traitement abortif de l'infection des plaies*. This was based upon the work carried out at the hospital at Compiègne, and was supplementary to the communication by Dakin mentioned above. He insisted at the outset upon the infectious nature of all wounds of war. He went on to point out that the antiseptic method had already been of immense service. It is puerile to deny definitely ascertained facts as has been tried in the name of laboratory experiences of a very debatable value. In surgery, as Pozzi said at the *Académie de Médecine*, the clinical argument overcomes all the others. As a matter of fact there has often been an abuse of antiseptics. These have sometimes been wrongly selected, and their use badly regulated. Their method of use, however, can easily be altered, and it is well known that technical improvement always, to a large extent, increases the efficiency of a method.

The chemical sterilization of a wound can only be realized by the use of an antiseptic powerfully germicidal and not irritating, and of a procedure which allows it to be in contact for a suitable time with the micro-organisms. For this reason, Dakin, after studying the *modus operandi* of the hypochlorites, sought for an energetic antiseptic solution, unirritating and of little cost. Hypochlorite of soda, prepared by Dakin's method, can be used in such concentration that it sterilizes the parts of the wound attacked by itself. If the solution penetrates into all the diverticula of the wound, and is constantly renewed there, complete sterilization can be secured. Carrel insists upon the need for early treatment, and upon the way in which the cleansing of wounds ought to be carried out to ensure the chemical sterilization of the wound.

An antiseptic only acts upon the part to which it is applied, and if this is kept up for a sufficient length of time. The antiseptic materials used up to the present are too feebly bactericidal or too irritating for the tissues, whilst the hypochlorite of soda, as prepared by Dakin, is not irritating, and its germicidal powers are high. *Eau de Javelle* (Liq. Sodæ Chlorinatae) must not be used, for its content of hypochlorite is very variable, and it may contain free chlorine or free alkali, which produces free soda by decomposing. Every ambulance dispenser can prepare Dakin's solution, which is used at a strength of 0.5 per cent. It is powerfully antiseptic, and can be applied freely to the skin and the tissues for several days, and even for several weeks, without causing any irritation. It should not be used at the same time as alcohol, and must never be warmed. For injection, an ordinary syringe, or, better still, a rubber ball-syringe, may be used. In the hospitals, a drop-apparatus is used with advantage.

The hypochlorite should penetrate all the crevices of the wound. It must constantly be renewed, for it decomposes in contact with protein matter. For instillation into the tissues, rubber tubes about 6 mm. in diameter are used, which have a single eyelet about $\frac{1}{2}$ c.m., from one end. The tubes are of various lengths, and are wrapped up

in sponge tissue. When the wound is narrow, or if a large wound has narrow diverticula, these sheathed tubes are introduced along its course. In the case of fracture, the end of the tube should be in among the fragments. When the fluid is injected into a tube, it soaks into the spongy tissue instead of running away at once, and thus remains in contact with the surface of the wound. In superficial wounds, and in large wounds with crevices, plain tubes are inserted to the bottom of the wound or the crevices, and the whole is then packed with gauze. The dressing is completed by covering up the wound with a layer of non-absorbent wool, through which the tubes run. Before this is applied, it must be ascertained that the fluid runs free from the tubes into the wound. A fresh supply of the solution is injected every hour or every two hours, but a better plan is to adopt continuous instillation.

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of a few c.c. of the following :—

Tincture of iodine	-	-	-	-	100 c.c.
Alcohol,					
Æther	-	-	-	-	of each 450 c.c.

If the patient is suffering from shock, or is in a serious condition with a small, quick pulse, the following mixture is used :—

Camphor	-	-	-	-	100 gr.
Alcohol,					
Æther	-	-	-	-	of each 450 c.c.

The advantages claimed for this method are, that it dries up the wound, does away with useless washings out, and checks very considerably both oozing and suppuration. It promotes continuous drainage, and keeps the wound in a bath, at once tonic, stimulating, and antiseptic. In particular, it allows of less frequent changing of the dressings. Three are usually enough to obtain considerable improvement. This is regarded as being actually its chief recommendation. After the dressing has been applied at the dressing station in the line, the wounded man must, by force of circumstances, undergo a long train journey. Changing dressings in the train is most frequently done under very faulty conditions, and it is of great advantage to have a dressing which can be left in place. All the treatment necessary is to inject, every two hours, a little of the alcohol and ether solution.

Since adopting this method, Dupuy has not seen any cases of gaseous gangrene. The wounds heal quickly, and the resistance of the patients is largely increased. Dupuy attributes his good results in part to the more speedy removal of the wounded from the front to the ambulance; the earlier treatment thus made possible greatly adds to the chances of success.—(*Journ. des Praticiens*, June 5, 1915.)

STERILIZED AMADOU AS A LOCAL HÆMOSTATIC IN WAR SURGERY.

Reynés points out that the exigencies of the war have revived several old-time methods of treatment, and among these is amadou, well known as a local hæmostatic from early times. It is easily sterilized by dry heat at a temperature of 130° to 140° C., and is in no way altered by this process; it remains quite soft and supple, and is ready for various purposes. Reynés has found its chief use to be in serious or obstinate hæmorrhage, when ligature is not possible, as in bone lesions in the limbs, or the skull, and in injuries of the meninges or cranial sinuses. Plugging with gauze is not very effective in these cases, but the use of amadou has always been successful. The strips of amadou are left in place for 24, 36, or 48 hours and then withdrawn. They do not adhere, and the hæmostasis remains secure.—(*Le progrès médical*, November, 1915.)

IODARGOL

**THE Specific of Gonorrhœa
Acute or Chronic.**

A Few Clinical Results.

2 Cases of Acute Gonorrhœa:

We deem it our duty to draw attention to this action of Colloidal Iodine, since it brings about a rapid and certain cure in gonorrhœa and causes a disappearance of the gonococci, without in any way interfering with the integrity of the organs.

DRS. MIETTE and TRUFFIER.

A Case of Gonorrhœal Follicular Urethritis:

It has seemed to us of some interest to report this case on account of the result obtained, and above all on account of the means employed for attaining it, for follicular abscesses of gonorrhœal origin, however they may start, always sooner or later acquire chronic symptoms, and we have never so far seen any but surgical treatment leading to a certain cure.

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ANDREWS, Miss., appointed Junior Obstetric Assistant, Royal Free Hospital, Gray's Inn Road, W.C.

BIRLEY, J. L., M.A., B.Ch. Oxon., M.R.C.P. Lond., appointed Medical Registrar, St. Thomas's Hospital.

BUCHAN, T., M.B., Ch.B. Edin., appointed Certifying Surgeon under the Factory and Workshop Acts for the Laurencekirk District of the county of Kincardine.

BUSTEED, J. H., L.R.C.P. & S. Edin., L.F.P.S. Glasg., appointed Certifying Surgeon under the Factory and Workshop Acts for the Bungay District of the Counties of Norfolk and Suffolk.

CAMERON, R. D., appointed Resident Surgeon at the Surgical Out-patient Department at the Royal Infirmary, Edinburgh.

CRUICKSHANK, MARY W., M.B., Ch.B. Aberd., appointed Temporary Assistant Medical Officer to the Aberdeen School Board.

DICK, JOHN, M.B., Ch.B. Edin., appointed Resident Physician at the Royal Infirmary, Edinburgh.

DOYNE, P. G., B.A., M.B., B.Ch. Oxon., F.R.C.S. Eng., appointed Ophthalmic Registrar, St. Thomas's Hospital.

EVANS, A. OWEN, M.B., Ch.B., appointed Resident Surgeon at the Royal Infirmary, Edinburgh.

EVANS, O. C. P., M.D. Durh., appointed Certifying Surgeon under the Factory and Workshop Acts for the Kidderminster District of the county of Worcester.

FOSTER, ANNIE, M.R.C.S., L.R.C.P., appointed to the Medical Staff of the Nottingham General Hospital.

GEMM, MAURICE, L.R.C.P. & S. Edin., L.F.P.S. Glasg., appointed Medical Officer of Health for the combined districts of South-West Shropshire.

GLEN - BOTT, Miss, M.R.C.S., L.R.C.P., appointed to the Medical Staff of the Nottingham General Hospital.

GRANT, PETER NAPIER, M.B., C.M. Glasg., appointed Surgeon to the Out-Patient Department for Diseases of the Throat and Nose to the Glasgow Royal Infirmary.

HOFFMAN, GEOFFREY, B.A., M.B., B.C. Cantab., M.R.O.P. Lond., appointed Resident Assistant Physician, St. Thomas's Hospital.

KERR, JAMES RUTHERFORD, Ch.M. (Glasg.), appointed Head Surgeon to the Allies Hospital (265 beds) at Yvetot, France.

KELLY, L. F., L.R.C.P. & S.I., appointed District Medical Officer of the Cleobury Mortimer Union.

LANDSEBOROUGH, WILLIAM, M.B., Ch.B. Edin., appointed Medical Referee under the Workmen's Compensation Act, 1906, for the Sheriffsdom of Ayr, to be attached more particularly to the Ayr district.

LEGGE, D. J. M., F.R.C.S. Edin., appointed District Medical Officer of the Shifnal Union.

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MITCHINER, P. H., M.B., M.S.
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MORTON, JOHN, M.B., C.M., ap-
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pointed Medical Inspector to the Local Government Board, Ireland, for the North-East District.

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We are asked by the Senate of London University to state that the Paul Philip Reitlinger Prize, offered this year for the best Essay on "The Economic Condition of the People of England in 1815 in comparison with the present day," has been awarded to Herbert Roland Hodges, of the London School of Economics. The Prize, this year of the value of £40, was founded with funds given to the University by Mr. Albert Reitlinger in memory of his son, a student of St. George's Hospital Medical School, who died on 3rd December 1911. Next year the Prize will be awarded for the best Essay embodying the result of some research work on a medical subject carried out by the Candidate.

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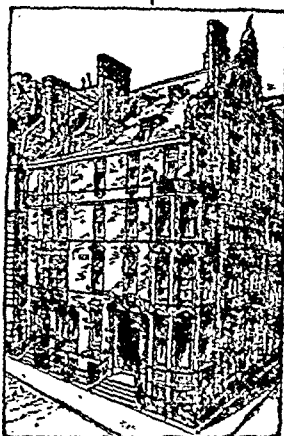
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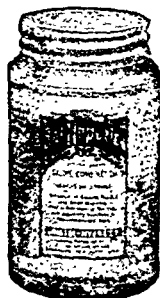
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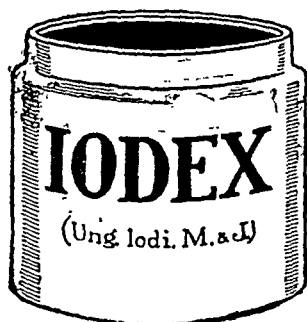
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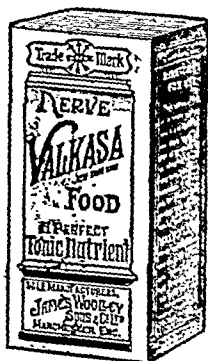
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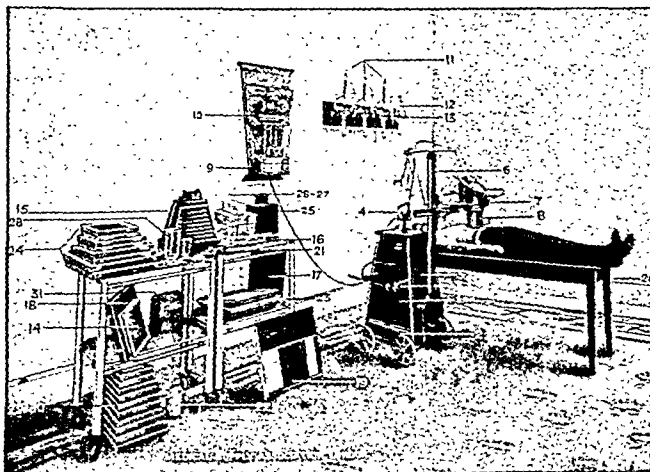
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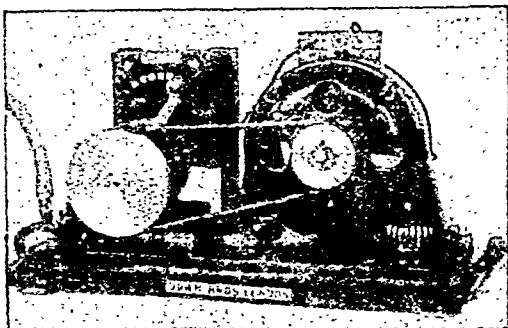
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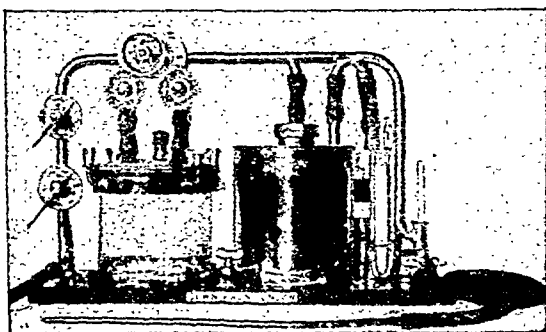
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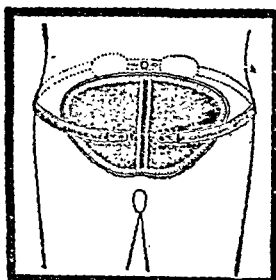
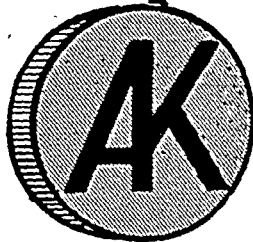
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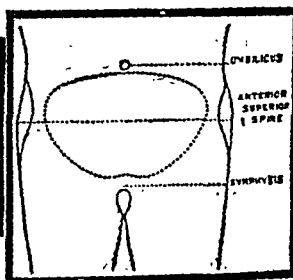
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In $\frac{1}{2}$ lb. containers 15/- per doz.

"Osacol" had extensive trials at the hands of a well-known London practitioner, whose reports induced the Oppenheimer Laboratories to place the preparation on the market.

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AN ABSOLUTELY STABLE AND UNIFORM PRODUCT THAT HAS GAINED WORLD-WIDE DISTINCTION THROUGH ITS DEPENDABLE THERAPEUTIC EFFECTS.

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The adult dose of the preparation is one teaspoonful repeated every two hours or at longer intervals, according to the requirements of the individual case.

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IF it be desired to administer the organic glycono-phosphates of Lecithin-Ovo in solution, the most palatable and efficient medium is Junora wine. Junora may be prescribed with advantage for malnutrition, anæmia, and debility, during convalescence and in other cases where Lecithin is indicated. Junora creates appetite, increases the activity of the blood-forming organs, strengthens the nervous system, and improves the whole nutritive condition. JUNORA is supplied in two strengths:—

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to
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- A. About $\frac{3}{4}$ -gr. Lecithin-Ovo products to the oz. $\frac{2}{11}$
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SPECIAL TERMS TO MEDICAL MEN.

A full-sized trial bottle of Junora will be sent free to any Doctor on application.

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Proprietors: Messrs. HUMPHREY TAYLOR & CO., Ltd.
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THE Lecithin-Ovo made by Messrs. Humphrey Taylor & Co. is the finest Lecithin obtainable. It is made exclusively in England, and is of uniform purity and efficiency. Every process of its manufacture has been examined and tested by the leading authorities on Lecithin in Great Britain, and their considered opinion is that Lecithin-Ovo thus obtained is superior in quality to any foreign preparation of Lecithin.

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40/- per lb.; $\frac{3}{6}$ per oz.

Lecithin-Ovo { $\frac{1}{2}$ grs., $\frac{4}{6}$ per 100.
Capsules { 3 grs., $\frac{8}{6}$ per 100.
Lecithin-Ovo { Finest quality from 10
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IN DIABETES, GOUT,
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Diabetes Whisky

(Late Proprietors: GEORGE BACK & Co., Ltd.)
PURE MALT. SUGAR FREE.
5/- per bot.; 55/- per doz., carr. paid.
GUARANTEED TEN YEARS OLD.

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After professional skill has succeeded in carrying the patient over the crisis of a serious illness, the regular use of "WINCARNIS" will promote a speedy convalescence and a rapid return to health.

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SAVARESSE'S CAPSULES

prevents the usual nausea and
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Each in
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to be administered subcutaneously for the production of
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A Hay Fever Reaction Outfit

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- (a) *whether a patient is susceptible to pollen toxin.*
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A uniform degree of Heat may be maintained for 24 hours, or longer, by applying

Directions:—Always heat in the original container by placing in hot water.

Needless exposure to the air impairs its osmotic properties—on which its therapeutic action largely depends.

Antiphlogistine

warm and thick, over the thorax, with a liberal margin overlapping the area involved.

In this way, the aggravating symptoms may be almost immediately ameliorated; the cutaneous reflexes stimulated, causing **contraction** of the deep-seated (and coincidentally **dilation** of the superficial) blood-vessels—flushing the peripheral capillaries.

Thus, the over-worked Heart is relieved from an excessive blood-pressure; congestion and pain also are relieved, and the temperature tends to decline as restoration to normal circulation ensues.

In order to AVOID "substitutes" Physicians should WRITE "Antiphlogistine."

"There's Only ONE Antiphlogistine."

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Gastro - Intestinal Disorders.

Angier's Emulsion is indicated in gastro-intestinal disorders of a catarrhal, fermentative, ulcerative or tubercular nature. Its soothing, healing action upon the gastro-intestinal mucous membrane; its powers of inhibiting noxious fermentation; and its general tonic effects make it eminently suitable in these cases. The Emulsion is palatable and is easily retained by sensitive stomachs. It may be administered either alone or in combination with other medicines. It is a perfect vehicle for all sorts of drugs, soluble or insoluble.

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Gastric Catarrh.—I find Angier's Emulsion increasingly appreciated by invalids suffering from gastric catarrh, as well as by those who are phthisical.

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Fermentative Dyspepsia.—I have personally used Angier's Emulsion for fermentative dyspepsia and flatulence, and have also frequently prescribed it for my patients. I have prescribed 5 minims of Nux Vomica in 3 oz. of Angier's twice daily after food with much success.

—, M.B.

Constipation.—... I have prescribed Angier's Emulsion in a great many cases in my private practice, and am firmly impressed with its beneficial effects, especially as a cure for constipation.

—, F.R.C.S.

Abdominal Tuberculosis.—I have found Angier's Emulsion very useful in cases of abdominal tuberculosis, and also in cases of general weakness. It is a most useful tonic and restorative.

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After Long Experience of many forms of paraffin and petroleum, both in the character of emulsions and otherwise, I have found none so satisfactory to the patient as Angier's Petroleum Emulsion. —, M.B., D.Sc., etc.

Free Samples to the Medical Profession.

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INSOMNIA

which is widely prevalent under the stress of present conditions, is being treated extensively, and with exceptionally gratifying results, by means of

THE LYMPHOID COMPOUND

(IN SOLUBLE CAPSULES).

FORMULA.

Exts. Brain, Spinal Cord, and Lymphatic Glands with Spermin	...	gr. 2
*Glycero-Phosphate Iron	...	gr. $\frac{1}{2}$
*Glycero-Phosphates Sodium and Calcium	...	gr. 2
*Aloin	...	gr. $\frac{1}{16}$

* Omitted when desired.

The rapid restoration and after maintenance of natural and undisturbed sleep results from the potent neurotonic effect which this treatment produces and which successfully combats Nervous Instability.

The preparation has been further clinically demonstrated to allay cerebral hyper-activity and excitability, to re-instate normal metabolic processes, to promote oxidation, to improve the blood state, to supply adequate cellular nutrition and compensation and to secure that balance in the inter-activity of the internal secretions which is essential to normal functioning and to the integrity of the chemistry of the organism.

A Typical Report reads:—

"I am pleased to tell you that the Lymphoid Compound has been remarkably successful in a case of intractable Insomnia in which I have recently employed it.

"The patient was an army officer who, for a long period, had been unable to sleep more than one or two hours each night and then only brokenly.

"All the usual remedies had been prescribed for him at various times without any result.

"After the administration of 200 of the Lymphoid Compound Capsules the Insomnia has entirely left him and he sleeps soundly and naturally from the time he retires to the time he is called, without any exception."

M.D. (Lond.)

Supplied to Practitioners or on their Prescriptions only.

Brochure No. 30 (with detailed information) post free on application.

The BRITISH ORGANOTHERAPY Co., Ltd.

Carlton House, Lower Regent Street, London, S.W.

Telephone: GERRARD 7111.

Telegrams and Cables: "LYMPHOID LONDON."

"PANCROBILIN" (REED & CARNRICK)

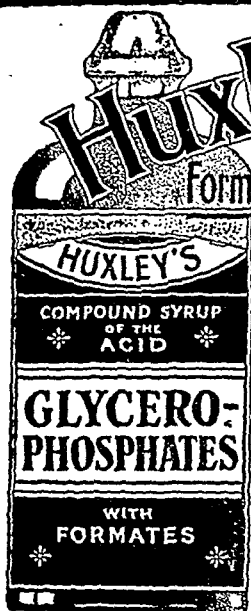
(NUCLEO-ENZYMES OF THE PANCREAS WITH DEHYDRATED BILE)

INCREASES THE FLOW OF BILE AND ACTIVITY OF LIVER PREVENTING THE FORMATION OF GALL-STONES.

MANY cases of constipation grow worse under the continued use of cathartics and purges. The normal stimulant to the intestines is found in the pancreatic juice and the bile. Pancrobilin is composed of the nucleoenzymes of the pancreas with dehydrated bile. The nucleo-enzymes of the pancreas are more active and truer to Nature's secretion than pancreatin. So dehydrated bile is better than the ordinary bile salts, because the water has been removed without the use of high heat, which changes the nature of the bile as it normally exists; consequently Pancrobilin is more effective than the usual combinations of pancreatin and desiccated bile.

*Original bottles of 100 gelatine-coated small pills for dispensing.
FREE SAMPLE TO PROFESSION.*

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Formates with Glycerophosphates

A bright ruby-coloured syrup or glycerol, sugar-free, containing the acid glycerophosphates and acid formates of lime, soda, potash, iron, manganese, and strychnine (5 grains of the combined salts with $\frac{1}{10}$ gr. of strychnine glycerophosphate per fluid drachm) flavoured with Seville or bitter orange peel. N.B.—Huxley's Syrup is also prepared without the formates, and without strychnine for children and others.

The formates have general tonic and stimulant effects, especially noticeable when used in conjunction with the glycerophosphates in neurasthenoid or neurasthenic states, or in abnormal fatigue from over-exertion, mental or physical.

Sold in bottles of $\frac{1}{2}$ lb. and 1 lb., and in W. qt. bottles for dispensing by all Dispensing Chemists. Free Sample from
Anglo-American Pharmaceutical Company, Ltd., Croydon (London).

INSOMNIA

which is widely prevalent under the stress of present conditions, is being treated extensively, and with exceptionally gratifying results, by means of

THE LYMPHOID COMPOUND

(IN SOLUBLE CAPSULES).

FORMULA.

Exts. Brain, Spinal Cord, and Lymphatic Glands with Spermin	...	gr. 2
*Glycero-Phosphate Iron	...	gr. $\frac{1}{2}$
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*Aloin	...	gr. $\frac{1}{10}$

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The preparation has been further clinically demonstrated to allay cerebral hyper-activity and excitability, to re-instate normal metabolic processes, to promote oxidation, to improve the blood state, to supply adequate cellular nutrition and compensation and to secure that balance in the inter-activity of the internal secretions which is essential to normal functioning and to the integrity of the chemistry of the organism.

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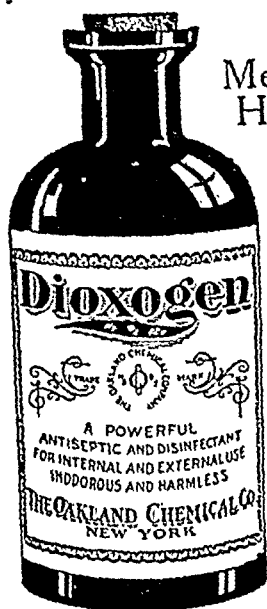
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The Pure Peroxide of Hydrogen.

Among the numerous germicides that have come into vogue since the inception of the antiseptic era none has a wider range of usefulness than "Dioxogen." Its merits have been abundantly demonstrated by chemical analysis and by clinical and laboratory experiments.



"Dioxogen" is invaluable in
Medicine, Surgery, Dentistry,
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"Dioxogen" is more powerful in germicidal value than 1 in. 1000 bichloride of mercury. Experiments within the last few years have proven conclusively that a solution consisting of one part "Dioxogen" to ten parts water will kill all forms of micro-organisms in a short time.

"Dioxogen" destroys pathogenic micro-organisms, checks purulent and foul secretions, and dissolves false membranes and sloughs.

"Dioxogen" will neither destroy nor harmfully affect the vitality of sound tissue. It is the best antiseptic for wounds and septic conditions.

Sample and Descriptive Pamphlet sent free on request.

Wholesale Agents: **Allen & Hanburys Ltd.,**
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"Bynin" Amara

(Trade Mark).

FORMULA.

Quinine Phosphate	1½ grs.
Iron Phosphate	2 grs.
Nux Vomica Alkaloids.. ..	¾ gr.
<small>(equal to Strychnine)</small>	
"Bynin," Liquid Malt	1 oz.

"A distinct advance on Easton's Syrup."

—THE LANCET.

"Bynin Amara" is an analogue of Easton's Syrup, over which it has, however, marked advantages. In this product, "Bynin," a pure, nutritious and highly active Liquid Malt, supersedes the inert basis of the official preparation.



"Bynin Amara" is vastly superior to Easton's Syrup; the dose can be regulated with exactness; the digestive organs are reinforced and the system is invigorated by its powerful tonic action. It not

only assists the digestion of food, but conserves and ensures complete assimilation.



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Free to Medical Men.

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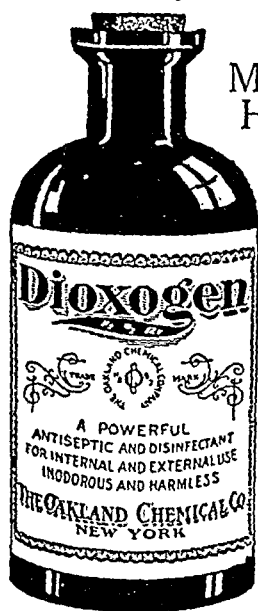
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KEPLER Malt Extract

THE MALT

with Glycerophosphates

AN ALTERNATIVE MALT EXTRACT

in which the nutritive value of the malt
phosphorus is reinforced by the addition of valuable
properties of the extract

Made entirely by Benger's Malt Extract Co. Ltd.
in Dundee, Scotland

Each half ounce contains
calcium glycerophosphate
or an equivalent amount
of sodium glycerophosphate
and sodium chloride

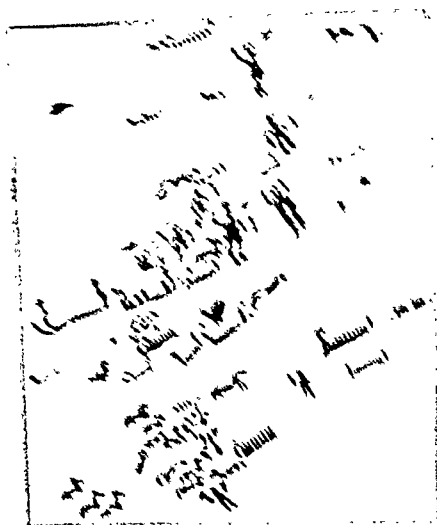
DIRECTION

One teaspoonful to two
teaspoonfuls twice or
three daily, with or
immediately after food.

Supplied in bottles of two
and of six ounces



BENGER'S
WELLCOME & CO.
LONDON



Prehistoric rock-drawings representing a
Viking raid. Men are fighting, high spears
one man is lying apparently dead, on front
of a boat, dogs and other domestic
animals are seen. Date: The Bronze Age.

COMBATS SERIES, 1—PREHISTORIC

When Prescribing Antipyretics

Highest therapeutic efficiency
is secured by specifying

'TABLOID' BRAND Aspirin

(Trade Mark)

Gr. 5 and 0.5 gm., issued in bottles of
25 and 100.

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Gr. 2, gr. 5 and 0.25 gm., issued in
bottles of 25 and 100; 0.1 gm., in
bottles of 25.

Antipyrine

Gr. 2½ (sugar-coated), gr. 5 and
0.25 gm. (plain or sugar-coated), and
0.5 gm. (plain), issued in bottles of
25 and 100.

Phenacetin

Gr. 1, gr. 5, 0.1 gm., 0.25 gm. and
0.5 gm., issued in bottles of 25 and 100.

Sodium Salicylate

Physiologically pure:—Gr. 3, gr. 5 and
0.5 gm., issued in bottles of 25 and
100; also 1 gm., in bottles of 25.
Natural:—Gr. 3 and gr. 5, issued in
bottles of 25.




BURROUGHS
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LONDON

Portion of a prehistoric Tombstone Slab, engraved
with silhouettes of an armed man driving three
captives before him, and followed by a man in a
horse-chariot. Date—The Bronze Age.

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THE PRACTITIONER.

FEBRUARY, 1916.

THE TREATMENT OF URGENT PLEURISY.

By SAMUEL WEST, M.D., F.R.C.P.

Consulting Physician to St. Bartholomew's Hospital, etc.

IN considering the urgent symptoms which may arise in the course of pleurisy and their treatment, the four chief forms of pleurisy must be dealt with separately, viz., dry pleurisy, pleurisy with serous effusion, empyema, and pneumothorax.

I.—DRY PLEURISY.

In *dry pleurisy*, the chief symptom is pain, the characteristic stitch in the side. This is usually associated with friction, of the nature of crepitation rather than of rubbing; the typical dry leather creak is by no means common. There may be distinct friction without pain, especially when the acute stage is past.

The pain varies with the depth of the respiratory movements, so that, to avoid depth, the respirations are shallow, and the rate of breathing may be increased, even as much as in pneumonia, and may result in the same perversion of the pulse-respiration ratio. The movements of the affected side are inhibited, as may be both seen and felt. Moreover, the pain may be radiated or referred, usually to the spots where the branches of the intercostal nerves become cutaneous, *i.e.*, near the spine, in the mid-axilla and in the middle line. With dry pleurisy low down, the pain may be referred to the abdomen most frequently in children, but also at times in adults. The diagnosis would have to be made from intercostal rheumatism and neuralgia, but presents, as a rule, no difficulty.

To relieve a bad stitch in pleurisy, counter-irritants and local anodynes are of little use. Even morphia often fails. Nothing is more certainly effective than local bleeding. Two or three leeches applied to the seat of pain will give speedy relief, and, though the friction may continue, the pain

CAUSERIE THÉRAPEUTIQUE.

COMBINED TREATMENT OF SYPHILIS.

The Treatment of Syphilis now recognised to be the best, and recommended by the leading specialists as such, consists in the use of 606 or 914 in conjunction with Mercurial treatment.

The combined treatment of Syphilis in any stage by **Supsalvs** in conjunction with **Mersalv** gives the best, safest, and quickest results.

No Harmful Effects. No Trouble.

Supsalvs are stable suppositories containing 0.10 grm. of 606 for rectal administration.

Mersalv contains 10 per cent. metallic mercury, which, by a special mechanical process, exists in the minutest state of sub-division possible. It is a non-greasy preparation, and in contradistinction to other mercurial preparations, contains no organic fats or oils. **Mersalv** is of a white creamy consistence, of pleasant odour, and cleanly in the method of application.

Method of Treatment.

One **Supsalvs** is introduced rectally every three days in conjunction with one teaspoonful, by *inunction*, of **Mersalv** every night. The parts most suitable for *inunction* are the inner surface of the arms and thighs.

Treatment is carried out for three weeks.

Then an interval of two weeks.

The treatment is then continued in the same manner till three distinct series of treatments have been made.

After this a Wassermann Blood Test should be made.

Supsalvs , adults, 0.10 grm., box of 6	12/-
" infants, 0.03 " " 6	7/6
Mersalv , pot of 2 oz. (15 days' treatment) ...	4/6
" pot of 4 oz. (one month's treatment) ...	7/6

Hot Climates.—**Supsalvs** are supplied each protected with a metallic envelope. **Mersalv** in special stoppered bottles.

Obtainable from—

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ELLIOTT BROTHERS, Ltd., Sydney and Brisbane.
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FELTON GRIMWADE & BICKFORD, Ltd., Fremantle.

NEW ZEALAND: NEW ZEALAND DRUG CO., Ltd., Auckland, Wellington, Christchurch, and Dunedin.

INDIA: J. MURRAY & Co., Ltd.—P.O. BOX 303 BOMBAY; P.O. BOX 226 CALCUTTA; P.O. BOX 226 MADRAS.

SOUTH AFRICA: LENNON, Ltd.
CANADA: EATON DRUG CO., Toronto.
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THE TREATMENT OF DIABETES.

Diabetes—that is to say, the elimination of glucose through the urine—is due to the deviation and the functional insufficiency of the two important viscera of the organism, the liver and the pancreas. For a considerable time medical men were of opinion that opotherapy—that is to say, the administration of the homologous organs derived from healthy animals—might supply this hepato-pancreatic deficiency, but many began to find that organic extracts exerted only a comparatively moderate influence. The treatment of diabetes mellitus has therefore remained *clinical*, and the drug which we now introduce, **DIABETIFUGE**, consists in a synthesis of the principal chemical agents that have yielded incontrovertible results in the treatment of Diabetes.

THE MEDICAL PROFESSION AND DIABETIFUGE.

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You kindly sent me some samples of **DIABETIFUGE** which I have tried in one old case of diabetes, with the result that the sugar has disappeared in 10 days, therefore I should be glad if you will send me another 6 doz. cachets.—MAJOR P.

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DR. P.

Directions.

Take each morning and afternoon one cachet, with half a glass of mineral water.

Continue for 10 days, make an analysis of the urine, and if the amount of sugar eliminated in the urine has decreased sufficiently reduce to 1 cachet during 10 days. Stop all treatment after taking the cachets for 20 days.

Rest for 20 days and then take up treatment again.

Price per box of 30 Cachets (for one month's treatment). 7/6.

anxious as these symptoms may be, and ill as the patient is, treatment is very unsatisfactory. Experience is opposed to the use of tuberculin in any form. The only cases in which I have thought benefit to be given have been those treated actively with mercury—in full doses, either in the form of perchloride of mercury, or of mercuric iodide.

2.—PLEURISY WITH SEROUS EFFUSION.

Serous effusion only gives rise to urgent symptoms under special circumstances.

- (1) If it be of large size with consequent extreme displacement of organs;
- (2) If it develop rapidly;
- (3) If it be bilateral; or
- (4) If it be complicated with some disease of the lung or heart.

Many large effusions, with extreme displacement of organs, produce few symptoms if they have developed slowly, but not so if the exudation of fluid has been rapid—and it may be very rapid, for instance, at the rate of 1–1½ ounces per hour—and, after removal, it may reform at the same rate and quickly demand removal again.

If the lung be already diseased, as in pneumonia or phthisis, a small effusion may produce a considerable effect.

With *morbus cordis*, where the lungs are in a condition of congestion, a small amount of fluid may cause considerable dyspnoea, especially when, as so often happens, the effusion is bilateral. The removal then of even a small amount of fluid from one side only will give great relief.

The symptoms are dyspnoea and cyanosis, and, in some cases, cardiac failure or syncope.

The *dyspnoea* and *cyanosis* are explained by the reduction of the respiratory capacity to which the effusion inevitably leads.

One lung becomes completely collapsed and functionless, and the other is greatly interfered with by the displacement of organs. In this way, the respiratory capacity may be reduced to little more than one-quarter of the normal. Even so great a reduction as this may be borne without extreme

will not usually recur. It is well to let the leech-bites bleed, and the bleeding may be encouraged by a warm poultice, on which some laudanum has been sprinkled.

If leeches are not thought desirable, much relief may be given by following the hint which nature gives and restricting the movements of the side. This may be effected by carrying a bandage firmly round the chest, but it has the disadvantage of checking the movements on the sound side as well. A better way is by strapping the side as for a broken rib, strips of sticking plaster an inch broad being applied from the sternum to the spine, care being taken to pull the skin in towards the seat of pain, so as to get the pressure maintained by the elasticity of the skin.

Cough may be a very troublesome symptom. It depends upon the irritation of the pleura. It not only increases the pain and distress, but may greatly interfere with sleep. Some sedative cough mixture may be tried, but opium will probably be necessary by the mouth, or better sub-cutaneously.

Hiccough is a still more troublesome and trying symptom, and, though usually due to the involvement of the diaphragmatic pleura, it may arise, as in peritonitis or pneumonia, without any such obvious cause. It may then be in itself a symptom of grave significance. Morphia must be given sub-cutaneously, but even in full doses it often fails.

Cutaneous hyperæsthesia occasionally accompanies the stitch in the side, and may be so pronounced as to render physical examination difficult, or make even the weight of the clothes unbearable. Fortunately, it is easily dealt with. If the affected area of the skin be brushed over once or twice with tincture of aconite, it will be quickly relieved, and may not again return. The application of a 10-20 per cent. solution of cocaine on a pad of lint will answer the same purpose, but the tincture of aconite is better.

Dry pleurisy is, in many cases, the result of tubercle, of which it may be the first evidence. This is almost certain, if the pleurisy be at the apex or widespread over the side, and still more if it be bilateral. In the case of acute tuberculosis of the lungs, in addition to the widespread pleurisy, the respiratory symptoms, viz., dyspnoea and cyanosis will be out of all proportion to the physical signs. Urgent and

and if, by the distension of the side, the respiratory movements are stopped, the pump ceases to work. Removal of some of the effusion, not necessarily a large amount, restores the respiratory movements, starts the pump to work again, and the effusion so long stationary rapidly disappears.

Two reasons given for early paracentesis (*i.e.*, for paracentesis within a few days of, or very soon after, the diagnosis) are not based upon fact—

- (1) that a serous effusion, if left more than a short time, changes its character and becomes purulent. This rarely if ever occurs spontaneously. A serous effusion remains serous throughout, unless it be injected with some pyogenic organism, and, as a rule, this is due to paracentesis with unclean instruments;
- (2) that the lung compressed by the effusion will soon contract adhesions and become bound down, so as to be incapable of re-expansion when the fluid is removed. This might, of course, happen, but, as a matter of fact, it does not; even after having been collapsed for months, the lungs may expand on the removal of the fluid as readily as if the effusion had lasted only a few days.

On the other hand, it has been urged that it is well not to be in too great a hurry to remove an effusion, on the ground that, in many of these cases, the lung is tuberculous, and that the compression of the lung by the effusion checks the developments of the tubercle in it.

This theory rests upon no evidence, and is, I believe, untrue. Though it is upon this theory that the treatment of phthisis by artificial pneumothorax is based, the advantage of this treatment must be proved by clinical experience and not by theory. The results show how much surgery phthisical patients will stand, but I have no doubt that this method of treatment will not stand the test of time.

The *risks of paracentesis* are very slight. Care must be taken to ascertain where the heart is so as to avoid it, but this is easy enough. The fear of wounding the intercostal artery exists chiefly in the imagination.

Puncture of the lung with the needle is of no importance.

distress, if the reduction has been slow and gradual. The remainder of the lung left to functionate is hard worked, but, for a time, does the extra work sufficiently well. At any time, however, and from very slight causes, the extra work may be more than it is longer equal to; the extra work becomes overwork, the respiration fails, and the signs of congestion, as it is called, appear, viz., rhonchus, sibilus and crepitation. These are the signs of *pulmonary failure or inadequacy*. They are associated with grave and rapidly increasing dyspnoea, and unless relief is given promptly by withdrawing the fluid, the patient will die.

It is remarkable, under such conditions, how rapidly the patient may pass from a condition of comparative ease to one of grave and urgent dyspnoea. Under these circumstances, paracentesis must be performed without delay (*Paracentesis necessitatis*).

Of the cardiac symptoms, *cardiac syncope* is the most serious, for it may be fatal. Fortunately, it is rare. It may occur without any warning, and with nothing on post-mortem examination to explain it, but it is more common among cases of organic disease of the heart.

An explanation—once popular, now almost forgotten, and rightly so—was that it was due to interference with the blood supply to the heart by the kinking of the vena cava, consequent on the displacement; but the most extreme displacement may be present without any evidence, post-mortem, of such kinking, and I have never been able to satisfy myself that the explanation was anything more than a plausible theory.

Grave dyspnoea may set in urgently in some cases, and prove to be due to *cardiac clotting* or *pulmonary embolism*, but such complications are of the greatest rarity.

In the absence of urgent symptoms, paracentesis is indicated when the effusion persists, without signs of diminution for some time.

The fluid is removed from the pleura, not by absorption, in the sense of being taken back into the blood vessels, but by the mechanical process of being pumped out of the pleura through the stomata into the lymphatics, along which, directed by the valves, it passes to the root of the lung. The pump is worked by the respiratory movements,

the lung to adjust itself to the new conditions, suffices to check it.

General discomfort and distress occur at times without any apparent cause, though, again, they are most common when the fluid is withdrawn too quickly. As the fluid flows, the patient becomes at first restless and fidgety, then looks distressed and anxious, and at last, without complaining of pain, says that he can bear it no longer. This is the most serious of all the indications, because it probably is, as I believe, cardiac in origin. Though nervous, it is not the effect of fright or excitement, for it often occurs in phlegmatic persons, and is not more common in the neurotic. When this symptom develops, paracentesis should be immediately stopped. The next day, or a day or two later, if paracentesis be again performed, it may not recur.

Change in the character of the fluid.—If blood or air suddenly appear during paracentesis, the operation should not be proceeded with, for air would mean that the lung had been ruptured, or an adhesion torn.

There are some curious cases in which, during the flow of serous fluid, pus suddenly makes its appearance. This is due to the pleurisy being loculated (polymorphic), and one of the loculi which contains pus being opened during the paracentesis. It need not interfere with the completion of the paracentesis, though of course the case will ultimately become one of empyema, and require treatment accordingly.

Copious expectoration (albuminous expectoration) is a rare event, and only occurs after a certain lapse of time after the paracentesis. Its pathology is difficult, and need not be discussed here. It is not due, as it was once thought to be, to the expectoration through the lung of the serous effusion, for the good reason, if for no other, that the analysis of the two fluids shows them to be of different composition.

Many of the symptoms described can be controlled by the administration of a little laudanum before the operation, but as they are useful clinical indications, they are better not masked.

After paracentesis is completed, 10–20 drops of laudanum, and a bandage carried firmly round the chest for a few hours,

Pneumothorax never results from simple puncture, and though it may occur when the aspirator is used, it is due to rupture of the lung from excessive suction.

Fatal shock is sometimes mentioned as a risk; it is so very rare as to be negligible. I have never seen it myself in puncture of the pleura, though I have in puncture of the abdomen more than once.

Method of Paracentesis.—The aspirator should never be used. If a serous effusion cannot be removed by syphonage, it cannot safely be dealt with by paracentesis. A cannula with india-rubber tubing from the bed to the floor will provide all the suction desirable, viz., 18–24 inches of water. Such a pressure cannot burst the lung, while it admits of all the fluid being removed, and provides for its being withdrawn slowly, thus avoiding all the symptoms which too rapid removal may induce, and which may require the suspension of the paracentesis before it is complete.

The symptoms which may lead to the *stoppage of the paracentesis* are: pain, cough, general distress, and change in character of the fluid as it flows.

Pain is generally due to the stretching of adhesions, but I presume the adhesions must involve the parietal pleura, for the pulmonary pleura is not sensitive. The pain may be felt in any part of the side, but generally in the upper part or in the mediastinum. It is not a common symptom in any degree of severity, since the aspirator has been abandoned and syphonage only employed. Sometimes, if the flow of fluid be stopped for a few minutes, the pain will be relieved, and will not return when the paracentesis is resumed. If it should return, the paracentesis must be terminated.

Cough may be due to the irritation of the pulmonary pleura by the cannula as the lung expands. If so, the withdrawal of the cannula for a short distance will cause it to cease. The more severe coughing has a different causation. It is probably the direct result of the expansion of the lung and of the renewed circulation of blood and air through it. It used to be frequent when the aspirator was the routine apparatus, and was due to the too rapid withdrawal of the fluid. It is not often severe with syphonage, and then the stopping of the flow for a few minutes, to give time for

the lung to adjust itself to the new conditions, suffices to check it.

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After paracentesis is completed, 10–20 drops of laudanum, and a bandage carried firmly round the chest for a few hours,

add greatly to the patient's comfort.

Finally, in refractory cases of serous effusion, the side may be opened, and the case treated as one of empyema, into which it will then be eventually converted.

3.—EMPYEMA.

Empyema.—Pus takes so much longer to form than serous effusion, that an empyema is usually diagnosed long before it reaches any size, so that the symptoms associated with large serous effusions just described are hardly ever met with. When empyema has been diagnosed, the sooner the pus is evacuated the better, though there is, as a rule, no immediate urgency.

Physical signs usually indicate the seat, and exploration with the needle establishes the diagnosis. There are cases, however, in which the physical signs are doubtful and the diagnosis is difficult. This is most likely to occur where the empyema is localized and deep seated, and lies either between the base of the lung and the diaphragm (basal or diaphragmatic) or between the lobes of the lung (interlobar). Then the diagnosis can only be made by the needle, and when found, the needle should be used as a director, and the knife passed along it till the pus is reached. The pus may lie so deep that, without the needle to guide him, the surgeon would not dare to push the knife so far.

In all cases, even in those in which the diagnosis seems to be quite simple and obvious, *the pus should be found with the needle first* at the time of operation before the knife is used. This is a rule which should, in no case, ever be departed from. Neglect of it will sooner or later lead to trouble.

When the empyema has been opened the *cavity should be completely emptied*, the patient being, if necessary, rolled over on to the affected side with this object.

The drainage tube.—It is very important that the *drainage tube* should not be longer than is necessary to keep the external wound sufficiently open to provide for free drainage. A long tube is a mistake, and delays cure.

When an ordinary empyema is opened, the lung being collapsed, the cavity is a deep one, and a tube of some inches can, of course, be easily inserted, but the lung quickly re-expands, and, within a few hours or less, may have reached

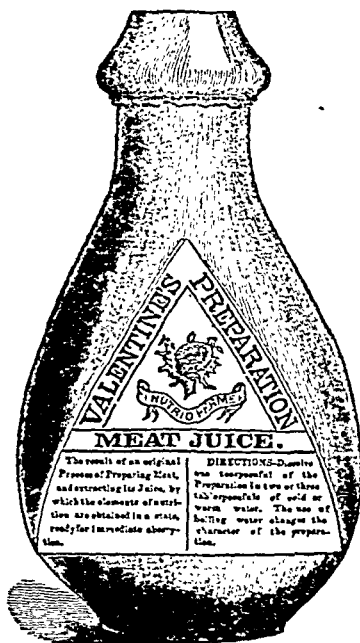
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the chest walls everywhere, except where the tube lies. If the tube be some inches long, a narrow track is thus left, which may be very difficult to get to heal. In this way, as the mere result of using too long a tube, complete recovery may be delayed for weeks.

In the cure of an empyema, the cavity is obliterated by the expansion of the lung, and not, as used to be taught, by adhesions and granulation from the bottom. The use of a long tube was thus based upon a false theory.

Long drainage tubes are hardly ever necessary, and, unless they are necessary, are mischievous.

Urgent symptoms in empyema are the result of *pointing*, or *actual perforation*.

When the empyema points externally, treatment is simple, but if it be desirable to open the empyema elsewhere, the threatened spot of rupture will probably subside.

The only difficulties likely to arise are those of diagnosis, *e.g.*, from abscesses of the chest wall, or, if near the heart, the swelling may pulsate and suggest an aneurysm.

For exploration and diagnosis, a needle and syringe is all that is necessary. The aspirator should be always avoided, for if there are risks of rupturing the lung with serous effusion, these risks are much greater with empyema. In the old days, when paracentesis was preferred to incision and the aspirator in common use, rupture of the lung and consequent pneumothorax was by no means rare.

A sign of impending perforation of the lung is paroxysmal cough, and this then becomes an indication for immediate operation.

Discharge of the pus through the lung has by no means the grave results which *a priori* might be expected; in fact, in the days before early incision was the rule, rupture through the lung was regarded as more favourable than spontaneous rupture externally through the chest wall. It is remarkable that infective pus should be expectorated in quantity, for weeks it may be, through the lung, without an infection of the lung following; yet, except for the cough and discomfort, and possibly the fœtor of the pus, no evil results follow. It is well to bear this in mind in those cases of empyema which are so tucked away that exploration fails to find them. If they burst through the

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been marked by no such urgent symptom or, indeed, by any marked symptoms at all, and, for this reason, these cases have been called latent or insidious pneumothorax.

These two groups must be dealt with separately, for the questions raised in them are different.

1. *Where the symptoms are urgent.*—Without any warning, it may be, and sometimes in the midst of apparently good health, the patient suddenly experiences pain or some other strange symptom in the side. The breathing at once becomes short and laboured, and rapidly reaches intense dyspnoea, with extreme and rapidly increasing cyanosis; unless relief be given, death may occur within an hour or two of onset.

There are some instances in which death has been immediate from shock, but they are rare and beyond treatment, so that they do not call for further consideration here.

The dyspnoea is associated with extreme displacement of organs, so that the respiratory capacity is suddenly reduced to one-third (or less) of the normal. The heart and lungs have had no time to adjust themselves to the altered conditions, and the consequent distress and danger is extreme. Gradually, if time be given, the necessary adjustment takes place, and though the displacement of organs continues as extreme as ever, the symptoms subside. Statistics show that in these cases the danger to life is at first, and that, with every hour that life is prolonged, the immediate prognosis improves.

There is another cause for urgent dyspnoea of a different kind, which should be mentioned. This is the sudden discharge into the air tubes on the sound side of the contents of phthisical cavities in the compressed lung, thus adding to the dyspnoea by the choking of the air tubes.

In these urgent cases, if relief is not given without delay, the patient will die. The air in the pleura upon which the compression of the lungs depends must be let out. Immediate paracentesis gives temporary relief; unfortunately, it does not last long, and must be repeated. For these recurrent cases the use of valved tubes has been suggested, with the object of leaving them in the side, but cases so treated, if life be prolonged, invariably end in empyema, and in the production of pyo-pneumothorax.

In such urgent cases, if repeated paracentesis fails to

lung, as they almost always do, if left alone, recovery is usually complete, though it may be long and tedious.

Spontaneous evacuation through the lung very rarely leads to pneumothorax, though, on the other hand, pneumothorax may very likely lead to infection of the pleura and so end as pyo-pneumothorax.

Double empyema, which is by no means rare in children and is occasionally met with in the adult as well, suggests urgency, but by no means so much as might be anticipated. Double incision might be expected to be attended with special risks, for double pneumothorax would be produced. If it were true that incision of the chest wall necessarily led to immediate collapse of the lung, the risks would be great, no doubt, but collapse of the lung does not occur as it theoretically ought to do; on the contrary, the respiratory movements keep the lung expanded, and may even force it into or through the wound in the chest wall. Still it is better, with double empyema, not to open both sides at the same time—though this has been done many times without harm—but to allow a day or two to intervene between the one operation and the other.

As to *washing out of the pleura*, most dogmatic assertions are made as to the danger of sudden collapse or death as the result of it. These assertions are simply the result of fear, and due to want of experience. I have washed the pleura out times without number, and have never seen a single bad result. To wash out the pleura is not only safe but should always be done, if necessary, though it is not necessary in all cases as a routine practice. There are two indications for it: the one, where there are *flakes of curdy pus*, for these flakes obstruct the tube and interfere with drainage, and their removal at the time of operation accelerates recovery. The second indication is *fætor*. This necessitates free washing out at the time, and subsequently, so long as the fætor lasts. Any simple disinfectant will suffice; that most in use is boric acid solution.

4.—PNEUMOTHORAX.

Pneumothorax.—The onset of pneumothorax is associated in general estimation with extremely urgent symptoms; yet there are many cases in which its recurrence has

been marked by no such urgent symptom or, indeed, by any marked symptoms at all, and, for this reason, these cases have been called latent or insidious pneumothorax.

These two groups must be dealt with separately, for the questions raised in them are different.

1. *Where the symptoms are urgent.*—Without any warning, it may be, and sometimes in the midst of apparently good health, the patient suddenly experiences pain or some other strange symptom in the side. The breathing at once becomes short and laboured, and rapidly reaches intense dyspnœa, with extreme and rapidly increasing cyanosis; unless relief be given, death may occur within an hour or two of onset.

There are some instances in which death has been immediate from shock, but they are rare and beyond treatment, so that they do not call for further consideration here.

The dyspnœa is associated with extreme displacement of organs, so that the respiratory capacity is suddenly reduced to one-third (or less) of the normal. The heart and lungs have had no time to adjust themselves to the altered conditions, and the consequent distress and danger is extreme. Gradually, if time be given, the necessary adjustment takes place, and though the displacement of organs continues as extreme as ever, the symptoms subside. Statistics show that in these cases the danger to life is at first, and that, with every hour that life is prolonged, the immediate prognosis improves.

There is another cause for urgent dyspnœa of a different kind, which should be mentioned. This is the sudden discharge into the air tubes on the sound side of the contents of phthisical cavities in the compressed lung, thus adding to the dyspnœa by the choking of the air tubes.

In these urgent cases, if relief is not given without delay, the patient will die. The air in the pleura upon which the compression of the lungs depends must be let out. Immediate paracentesis gives temporary relief; unfortunately, it does not last long, and must be repeated. For these recurrent cases the use of valved tubes has been suggested, with the object of leaving them in the side, but cases so treated, if life be prolonged, invariably end in empyema, and in the production of pyo-pneumothorax.

In such urgent cases, if repeated paracentesis fails to

give permanent relief, vent to the air should be provided by free incision.

2. *Where the symptoms are not urgent.*—When the pneumothorax has lasted some time, whether its onset was urgent or not, the questions which arise are of a different kind, and vary again upon whether fluid has formed, and what the nature of the fluid is—whether serous or purulent.

It is not always easy to decide whether fluid is present or not, for a large amount may lie in the lower part of the pleura, as in a saucer, without betraying itself to percussion. Even a needle may not obtain anything but air, even when a considerable amount of fluid is present, unless care be taken on exploration that the mouth of the needle or cannula be below the level of the fluid, and be thrust far down into the most dependent part of the pleura.

‘Succussion or splashing is decisive of the presence of fluid and air, provided the possibility of its origin in the stomach be excluded, which is easy enough. Even then the fluid must be splashable, for pus may be too thick and viscid to yield the sign.

Another point of use in diagnosis in some cases is the ready alteration in the level of percussion-dulness on change of position. With simple effusion, this only occurs after a time, and not at once, as in hydro- or pyo-pneumothorax, so that this sign, like succussion, is pathognomonic, when present.

If no fluid be present, the side is best left alone, for the air is readily absorbed, and often with great rapidity, so that, in a few days it may be, the lung is again fully expanded and in contact with the chest wall. I have seen this happen within a fortnight in a patient who was dying of phthisis, and did actually die within the month.

The ready absorption of the oxygen and carbonic acid can easily be understood. The disappearance of the nitrogen is difficult to explain, and though analysis shows that the oxygen is absorbed more readily than the carbonic acid, and the carbonic acid than the nitrogen, yet the difference is not as great as might be expected. The results of artificial pneumothorax show how readily all the gases disappear, so that it is difficult to maintain an artificial pneumothorax many days without repeating the injection

of air.

With *hydropneumothorax*, *i.e.*, where the fluid is serous, the treatment should be that of serous effusion, but here, more than in serous effusion, the aspirator should be scrupulously avoided, if it be found advisable to remove the fluid.

With *pyo-pneumothorax*, the treatment, in my opinion, should be that of empyema, and be largely governed by the general rules which apply to empyema.

It used to be dogmatically asserted that pyo-pneumothorax was invariably fatal, and that surgical interference only accelerated the fatal result. Whence this opinion was derived I do not know, but it dominated practice until quite recently. If an empyema were left for months unrelieved, the result would be disastrous, and why should a different result be expected in the case of a neglected pyo-pneumothorax? If however, pyo-pneumothorax be treated on the same lines as empyema, and opened and drained so soon as the presence of pus is established, a much more favourable result is obtained.

Some years ago now, I stated this opinion emphatically, and published a series of successful cases. Since then I think, as I certainly hope, that this common-sense view of the treatment of pyo-pneumothorax is now established. In my original communication, I recorded two cases of pyo-pneumothorax, which had been deliberately left alone for some months before they came under my care. Even then, with all that loss of time to contend with, the opening and draining of the side led to recovery.

To sum up the treatment of pneumothorax, I should say leave simple pneumothorax alone, unless symptoms are urgent and necessitate interference. Treat hydro-, or pyo-pneumothorax, on general lines, as if they were cases of serous effusion or empyema.

If these rules be followed, the results will be greatly improved.



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for it is difficult to judge of the possibilities of any system of feeding, unless considerable opportunity is afforded for manipulating it, as far as its limitations allow, to the varying requirements of a large number of different infants.

In my own Infant Consultation in Marylebone, where I have a large number of students to teach, I have thought it unwise to confine myself to any one particular kind of food, or any one particular method of feeding, and, among other methods I occasionally use the "citrated whole-milk" method, chiefly, however, for the purpose of demonstration.

After many years' experience, I have come to the conclusion that, provided one is familiar with the principles of physiological feeding, it makes very little difference what food one employs; whether, for instance, one uses dairy milk so called, dried milk, condensed milk, or even milk synthesized from its independent elements. The essential conditions are as follows:—

- (1) That the necessary elements for growth, maintenance, heat-production, energy-production and the elaboration of secretions are supplied in the proportions, and in the quantities required in each particular case.
- (2) That these elements are presented in a form capable of being digested and assimilated, and otherwise suited to the specific physiological make-up of the infant to whom they are supplied.
- (3) That the food is of such a nature as to exercise and develop the latent digestive capacities preparatory to a more extensive dietary.

Each individual, young or old, has his own specific physiological make-up, a make-up which depends on an enormous number of varying conditions, which include racial, hereditary, familial, and individual idiosyncracies, the latter consisting of tendencies or habits to digest, absorb, metabolize, secrete and excrete in some particular way. These idiosyncracies must be humoured by corresponding adaptations in the diet, if the best results are to be obtained, unless, indeed, we can rely on the possibility of modifying the infant to the specific qualities of the food which we supply. This is where, I think, my views differ from those of Dr. Vining. He believes,

THE CITRATED WHOLE-MILK METHOD IN THE
FEEDING OF INFANTS.

BY ERIC PRITCHARD, M.A., M.D., M.R.C.P.

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Out-patients, City of London Hospital for Diseases of the
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BEFORE discussing this question I would like to make it perfectly clear that I hold no brief for any particular kind of food. On the other hand, I have very deep-rooted convictions that the principles of "physiological feeding," or the adaptation of the food to the individual requirements of each particular child, must be the basis of every sound method of feeding.

I have been prompted to write this article after reading Dr. Vining's extremely interesting plea for the use of "citrated whole-milk," which was published last year in the November number of THE PRACTITIONER. In the main, I agree with him, that it is a method which gives good results, but my contention is that it does not give *the best* results.

Some eight years ago, when Dr. Ronald Carter accepted the post of medical officer to a new Infant Consultation Centre in Kensington, I represented to him that extremely interesting light might be thrown on the value of the "citrated whole-milk" method if he were, for a time at least, to use this method exclusively in the feeding of the large number of infants which it was anticipated would attend this centre. The results which he obtained proved that it was a good, simple, and generally satisfactory method for general use among the poor. As it happens, I met Dr. Carter a few days ago, and he now tells me that he has abandoned the exclusive use of this method, and, at the present time, employs methods which involve principles of greater elasticity. I am very glad that we have on record^{*} Dr. Carter's experiences with the "whole-milk" method,

* See the Article by Dr. Carter, which follows this, commencing on page 154—Editor, THE PRACTITIONER.

diet for a growing baby than one consisting of any one of the proximate principles without the others, or in double combination. Having made this admission, let us next enquire whether any special combination arranged in any particular proportion would be better than any other.

One must suppose that, as the result of millions of years of experimentation, Nature has provided each variety of mammal with the combination of these elements in its own milk, which is best suited to the physiological make-up of its own particular young. The milk of the dolphin contains 47 per cent. of fat as compared with about 3.5 per cent. in human milk, because to maintain bodily heat of a young animal swimming about in icy cold water a large quantity of food with a high caloric value is required. The milk of the rabbit contains 10 per cent. protein as compared with 1.5 per cent. in human milk, because the young rabbit grows extremely rapidly, and requires a considerable quantity of a nitrogen-yielding food for this purpose. And so on through the whole series of mammals.

In human milk, the proteins, the fats, and the sugars, are in the proportion of 1.5, 4, and 6.5 respectively, because this combination is best adapted to the physiological "make-up" of the infant; namely, to its functions of digestion, absorption, metabolism, secretion, etc., as well as to the conditions of the temperature to which it is normally exposed, and to its habits of muscular exercise and all those events which make up the sum total of its daily experiences. In cow's milk, the proportions are 4, 3.5, and 4.5 respectively. In this connection, I would point out that Dr. Vining's figures, with regard to the relative proportions of the various elements—protein, fats, and carbohydrates—in cow's milk and human milk respectively, are incorrect. He says the difference between the amount of lactose in the two varieties is only 10 per cent. I should say, making full allowance for discrepancies between different analyses, that 25 per cent. was nearer the truth. As regards the protein, made up of caseinogen and lactalbumen, he says the difference is something less than 10 per cent., if he had said 100 or even 150 per cent. he would have been nearer the mark. On the basis of this reputed similarity in the chemical make-up of the two milks, a similarity which does not exist, he disposes of the

if I mistake not, that one can so modify the specific physiological make-up of the average infant, that the latter can be made to subsist on the dietary which Nature has ordained should be the food of the calf. Whereas I claim that a large number of infants will refuse thus to be modified, and die before they submit.

It is not very difficult, by calorimetric and metabolism experiments, to calculate the caloric value of the food which must be supplied to any particular living organism, be it animal, man, or child, to enable it to perform the necessary functions of life, which include growth, maintenance, heat and energy production, secretion, and excretion. These calculations have repeatedly been made in the case of infants by Rubner and other physiologists. But although I am very much inclined to suspect the complete accuracy of their results, chiefly because they have not sufficiently taken into account the determining factors of external temperatures, clothing, muscular movements, and metabolic habits, yet, none the less, I think we may say fairly confidently that, for any given baby, we can approximately estimate the food requirements in terms of calories and on a basis of weight and age.

Thus, we know approximately that, taking an average baby three months of age and 10 lbs. in weight, the requirements for the 24 hours will be an amount of food which yields 495 calories. This calculation is made on the basis that about 94 calories are required for every kilogram of body weight.

The question now arises, is it of importance, from the point of view of the specific physiological make-up of the infant, in what manner this food is presented? Does it matter, for instance, whether we supply food yielding this number of calories in the form of pure protein, pure carbohydrate, or pure fat? Common-sense tells us that since the food has to supply the material for growth as well as for energy and heat production, the food must at least contain some protein elements. We know further that fat, which has a high caloric value, is well suited to the purposes of heat production, and experience tells us that carbohydrates are well suited for energy production. Therefore, on *a priori* grounds, we must conclude that, apart from other reasons, a mixed diet of proteins, carbohydrates, and fats would be a better

diet for a growing baby than one consisting of any one of the proximate principles without the others, or in double combination. Having made this admission, let us next enquire whether any special combination arranged in any particular proportion would be better than any other.

One must suppose that, as the result of millions of years of experimentation, Nature has provided each variety of mammal with the combination of these elements in its own milk, which is best suited to the physiological make-up of its own particular young. The milk of the dolphin contains 47 per cent. of fat as compared with about 3.5 per cent. in human milk, because to maintain bodily heat of a young animal swimming about in icy cold water a large quantity of food with a high caloric value is required. The milk of the rabbit contains 10 per cent. protein as compared with 1.5 per cent. in human milk, because the young rabbit grows extremely rapidly, and requires a considerable quantity of a nitrogen-yielding food for this purpose. And so on through the whole series of mammals.

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central argument against the substitution of the one milk for the other in the feeding of young mammals, or the use of whole milk for infant-feeding.

If, therefore, we wish to adapt the food to the physiological requirements in feeding our three months' old baby, we should supply the food which is to yield the 495 calories in a form which contains the proteins, the fats, and the carbohydrates in the proportion of 1.5, 3.5, 6.5. In other words, we should give :

375 oz. of casein,
1 oz. of fat,
1.6 ozs. of sugar.

It is not, however, enough that the food supplied should be compounded of the above elements and in the above proportions. It is requisite, too, that these elements should be presented in a form capable of being tolerated by the stomach and intestines, and of being digested. This brings me to the question of dilution. I do not think it is possible to exaggerate the importance of the size or bulk of the individual feeds given to young infants. I believe, figuratively speaking, that infants are often drowned in the excess of water with which the food elements are diluted, and that in the limited quantity of water which the "whole-milk" method implies, is to be discovered the secret of its success. We have become so accustomed to think and to speak in terms of percentages, as far as the protein, fat, and carbohydrate elements are concerned, that we are apt to forget about the water. As long as these main food elements are supplied in quantities which correspond with the physiological requirements of nutrition, it is, in my opinion, a matter of very little importance from the nutritional point of view with how much or how little water they are supplied; from the point of view, however, of the behaviour of the stomach or intestines, and, perhaps, too, from the point of view of the circulatory and excretory organs, the degree of dilution may make all the difference. For instance, I often find that when the motor functions of the stomach are disorganized in infants, a very common condition, which may be proved by the Bismuth meal and the X-ray screen, they will tolerate small quantities of food in very concentrated form, when the same food elements

given with a large amount of water may cause considerable disturbances.

In certain cases, I have given condensed milk in its native form, without any water at all, with the most excellent results. In others I have employed dried milk, diluted with half the amount of water necessary to restore it to the strength of ordinary undiluted cow's milk.

I do not believe that the fat and sugar dyspepsias, which are so common in infancy, are often due to excessive "*percentages*" of cream or soluble carbohydrates. These dyspepsias occur because the total amount of these elements supplied in the 24 hours, or any other unit of time, is more than the organism can accommodate. Nor do I believe, that caseinogen, even when given in very high percentages provided it does not coagulate in a heavy clot, is calculated as a rule to cause any disturbance of digestion.

I have on many occasions given sanatogen, or its equivalent (caseinogen and glycerophosphate of calcium), as well as whey proteins, casumen, and other forms of casein in 5, 6 or 7 per cent. strength, without any disturbances of digestion. But a daily total of casein, of fat, or of whey, given in excess for any long-continued period of time, is quite certain to result in the breakdown of the digestive functions at that particular point in the chain of digestive processes, which happens to be the weakest, or on which the incidence of the injury most acutely falls. I regard these dyspeptic phenomena as manifestations of the calling into play of protective mechanisms. It is the duty of the physician to interpret the meaning of these so-called pathological manifestations, and to modify the food in accordance with his findings. I cannot believe that he can acquire the necessary experiences to do so correctly, if his practice is confined to one method of feeding, nor that it is possible to find the antidote to the evils he discovers, unless he has a large number of resources at command.

The method of "percentage feeding" has been subjected to much adverse criticisms, chiefly by people who have not understood the significance of the term. Without it, however, it is impossible to write out with any degree of accuracy the formulary for the preparation of any food or milk mixture, so as to comply with any quantitative or qualitative

requirements. With familiarity with its usage it is quite easy to discover the weak spot of any mixture, no matter of what constituents it may be compounded, and to correct the error. On a percentage basis, it is little more difficult to employ the top-milk method than to prepare a milk mixture of any required percentage composition by combination of milk, cream, sugar, and water, or by combination of pure casein, butter fat, lactose, salts, etc. But it is almost impossible for a physician who confines himself to one method, let us say the "citrate whole-milk" method, to criticize the weaknesses of other methods which have failed in particular instances. I do not think that those to whom the limits of dietetic treatment are circumscribed by the restrictions of a single method are likely to possess the resourcefulness which is so requisite for solving feeding problems.

With respect to the choice of the protein element which should be supplied to infants, it is important that we should remember the recent work of Emil Fischer with regard to the chemical constitution of the various bodily tissues for the development of which, in the growing infant, building material must be provided. It has been shown by this investigator that each tissue has its own specific make-up, and that for its development certain definite bricks or building material are required in a correct proportion. These bricks are amino-acids (peptides), or chains of amino-acids (polypeptides), grouped together in ester combinations or piperazine rings. Can these bricks be obtained equally well from all varieties of proteins? No, certainly not. For instance, the human baby would find it exceedingly difficult or impossible to obtain all the bricks necessary for building purposes from a vegetable protein. The protein, which, when broken down into separate bricks by the processes of digestion, best fulfils the required conditions, is the protein, or proteins, contained in its mother's milk. The proteins of cow's milk also contain the required elements, but probably not in so economical a form. If mixed proteins are given, it is improbable that any required kind or shape of brick will be absent, but some may be present in unnecessary excess, and cause trouble from this cause. Problems in connection with this side of development are numerous and difficult.

Then, again, there are other problems associated with

the presence in the food of certain indefinite bodies, which have an influence on nutrition totally out of proportion to their bulk, and which, for want of a better name, have been called *vitamines*. These bodies, whatever be their function, appear to be essential to good nutrition, and, if not present in the staple or routine dietary, must be supplied independently in some other form.

These, and many other points of difficulty, arise in connection with the feeding of infants, but it is a great mistake to imagine that these dietetic problems can be settled by formula. It has, indeed, been suggested that competent authorities should formulate a standard dietary for the feeding of infants, which should be universally employed, irrespective of the individual idiosyncracies of the child. The Association of Infant Welfare and Maternity Centres is bombarded with such requests. This Association, to which some 300 local centres are affiliated, and which may be considered to be their mouth-piece and central authority, has constantly refused to draw up any such formulary, for it conceives that the main use of Infant Consultation Centres is to afford expert assistance in cases in which the feeding requires individual adaptation.

As long as infants refuse to conform to standard, it is impossible to standardize their food. There can be no master antidote for, or universal prophylactic against one and every variety of digestive, assimilative, metabolic, secretory and excretory defect which is liable to occur in infants, and which is very largely dependent on food causes. For this reason, I do not believe that there can be such a thing as a "best" food for infants; the best food for each individual infant is that which is best adapted to its general physiological make-up, and it will be different in each case. If expert advice cannot be procured to decide what is the "best" food for any particular case, it may be necessary to fall back upon some food which practical experience shows is likely to do least injury in the largest number of cases, and which is easy and simple to use. With the multiplication of Infant Consultations the instances in which feeding by formula must be resorted to, are likely to become fewer and fewer. I think, however, it would be a most retrogressive step to legislate for such a poor

standard as feeding by formula requires, far more profitable to devote our energies to the spread of a better knowledge. Dr. Vining says: "few of us have time or patience to wade through this multitude of detail"—*i.e.*, the detail necessary for understanding the quantitative compounding of the food. For my part, I think that the importance of the subject justifies the expenditure of just as much time and patience as may be required to acquire the necessary degree of knowledge. If those, to whom the public, and, in certain cases, the profession, look for light and guidance in these matters, say that the details of accurate modification are too difficult to understand, it is quite certain that the control and management of infant feeding will pass out of the hands of medical men into those of nurses and health visitors, many of whom are now making a serious study of the subject, and who have both the time and the patience to master the details.

In connection with the use of dried milk, Dr. Vining says: "It is a pity the profession should have given the dried milk so much support," and he proceeds to found his objections to its use on the grounds of bacterial contamination. It is quite true that many brands of dried milk, and those which most closely resemble fresh milk, are not bacteria-free, but, even in this respect, they have the advantage of dairy milk of the best quality obtainable. Very few dairy milks, however carefully handled, contain a lower bacterial count than 8,000 bacteria per c.c., and such milk would cost about eightpence per quart. An average sample of dried milk, desiccated by the most scientific method, *i.e.*, the Bévenot-de-Neveu process, contains from 4,000 to 10,000 bacteria per gramme weight. In other words, when reconstituted with sterile water, it will only contain from 500 to 1,200 bacteria per c.c.

Judged on the criterion of bacterial impurity, the best dairy milk is eight times as impure as an average sample of dried milk. If Dr. Vining has any doubts about the safety of giving such a dried milk to a young infant, there is absolutely no reason why he should not have the reconstructed milk boiled or scalded in the same way that he advises dairy milk should be boiled or scalded before it is administered to the infant. I think, however, that if Dr. Vining will read Dr. S. Delepine's report to the Local Government

Board upon "the effects of certain condensing and drying processes used in the preservation of milk upon its bacterial contents" (*Food Reports*, No. 21, 1914), he will have no further anxieties on this score.

I have had a long experience of the use of dried milks in the feeding of infants, and I can safely say that they give very good results, when used with discrimination. But, in my opinion, the same objection holds to their use when diluted with water as holds in the case of "whole milk." If dried milk is reconstituted with eight parts of water, we return to the condition of whole milk, and if we attempt to feed an infant on such a food, we presuppose that a baby's digestive, assimilative, metabolic, and excretory functions are the same as those of a calf. To use dried milk to the best advantage it must be modified to the special requirements of each infant, or, at least, to the standard of human milk.

The conclusions, then, at which I arrive are, firstly, that the "citrated whole-milk" method is physiologically unsound, because it allows no latitude for adaptation to the individual's digestive, assimilative, metabolic, and secretory activities, and that its use imposes obligatory modification of the infant. Secondly, that it affords little scope for the study of the influence of variations in the diet. Thirdly, that if the principles of percentage feeding are understood, a satisfactory food can be synthesized in a great variety of ways to satisfy the physiological requirements of any particular child; and fourthly, that dried milk, if properly modified and of good quality, has all the advantages, and few of the disadvantages, of so-called dairy milk.

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and can rarely be called clean. After the heating process, I advised that the jug should be covered over with a piece of muslin or clean paper, and the edges bound round with string ; the jug now should be placed in a basin of cold water until required for use.

Each meal was prepared separately, and I found that this had a most excellent educational influence. Women, who formerly had never thought of looking at the marks on the feeding bottles, or at any other form of measurement, now became interested, and for the first time in their lives realized the importance of quantities. I merely mention these details to show how difficult our work is amongst the poor and ignorant, whatever form of feeding is adopted, and I used whole citrated milk quite as much for the benefit of the mother as for the child. The value of this lesson has been fully justified in the case of many young mothers, whose subsequent babies progressed better than the first, because the mothers were able to carry out more elaborate formulæ, which, in many instances, produced better results than the whole-milk process. There can be no doubt that I got good results, on the whole, with undiluted citrated milk when I used it as a routine method during the first two or three years, but I have got much better results during the last six years by abandoning all routine methods and concentrating more on the individual requirements of each case.

The most successful cases of feeding on whole milk occurred amongst wasted infants, and this is rather what one would expect. These cases had mostly been fed on very dilute mixtures, often containing no additional fat or sugar, they commonly suffered from dilated stomachs, accompanied by vomiting and diarrhœa. The citrated milk, on account of its small bulk, is particularly suitable in these conditions, and the excess of proteid can, no doubt, readily be utilized by the tissues for building up the framework of the body in cases of starvation. It is certainly a remarkable fact that the digestion of a weakly child is able to deal with whole milk, when all clot formation is prevented by the addition of citrate of soda.

I was not, however, satisfied that these good results were entirely due to whole milk feeding, so I arranged to feed another series of wasted infants on mixtures of varying

THE USE OF UNDILUTED CITRATED MILK IN
THE FEEDING OF INFANTS.

By RONALD CARTER, M.D., M.R.C.S., L.R.C.P.

Physician to Infant Consultations, North Kensington.

DURING the last eight years, I have had considerable experience in the use of undiluted citrated milk at my Infant Consultations in North Kensington. When I commenced this work, I found that the mothers did not realize the importance of measuring the quantities of food that they were giving to their babies, so that all elaborate mixtures had small chance of success. Professor Budin's experiment in Paris with undiluted sterilized milk prompted me to try a similar experiment in Kensington, substituting citrate of soda for the process of sterilization. In both instances, clotting of the milk is prevented. I followed his directions with regard to the quantity of milk to be given, viz., $\frac{1}{10}$ th of the body-weight, but I soon found that the general condition of the child was a better guide than the body-weight as to quantity, and that it was always safest to begin with small amounts, and gradually increase. Another point I found of great importance, was to insist on clock-like regularity of feeding, and to make the intervals between the feeds as long as possible, so that the stomach was empty before the next meal. In order to ensure regularity, it was necessary to write down the times of feeding on a card, which was handed to the mother, or whoever was in charge of the child.

Contrary to the generally accepted method of giving two grains of citrate of soda to each ounce of milk, I gave only one grain, and this was usually sufficient. I told the mother to add another grain if vomiting occurred. No specially prepared milk was used. I instructed the mothers to receive the milk in a clean jug, and then to place the jug in a saucepan of water, and allow the water to boil for five minutes. It is important that the milk itself should not be placed in a saucepan and boiled, because the "family saucepan" has a great deal of work to do in the houses of the poor

and can rarely be called clean. After the heating process, I advised that the jug should be covered over with a piece of muslin or clean paper, and the edges bound round with string ; the jug now should be placed in a basin of cold water until required for use.

Each meal was prepared separately, and I found that this had a most excellent educational influence. Women, who formerly had never thought of looking at the marks on the feeding bottles, or at any other form of measurement, now became interested, and for the first time in their lives realized the importance of quantities. I merely mention these details to show how difficult our work is amongst the poor and ignorant, whatever form of feeding is adopted, and I used whole citrated milk quite as much for the benefit of the mother as for the child. The value of this lesson has been fully justified in the case of many young mothers, whose subsequent babies progressed better than the first, because the mothers were able to carry out more elaborate formulæ, which, in many instances, produced better results than the whole-milk process. There can be no doubt that I got good results, on the whole, with undiluted citrated milk when I used it as a routine method during the first two or three years, but I have got much better results during the last six years by abandoning all routine methods and concentrating more on the individual requirements of each case.

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I was not, however, satisfied that these good results were entirely due to whole milk feeding, so I arranged to feed another series of wasted infants on mixtures of varying

amounts of cow's milk, water, sugar of milk, and a "cream solution" consisting of equal parts of linseed oil and lime water. In this latter series of cases I paid special attention to the intelligence of the mother. The exact amount of each constituent was carefully explained to her, and, in addition, the composition of each feed, and the times for feeding were written down on a card, which she took home with her.

At the next and subsequent weekly visits, the mother was cross-examined with regard to the quantities which she put into each bottle. It was evident that, when the child progressed, the mother took an increasing interest in the variations of each constituent of the diet, because she saw that it "paid."

I included 30 cases in each group, and they were under observation for three months. All the babies were young, and the general environment was very similar in both groups.

On comparing the results of these two groups, I found that the whole-milk feeding produced a more rapid rise in weight than the diluted milk feeding. In three instances, the rise in weight of 1 lb. a week was alarming, and I found that the mothers had not been attending regularly, and had increased the food without advice, with the result that, in two cases, the children became very ill, but did not die.

The weight-curve in the diluted milk series showed a more gradual rise, and the babies did not have any violent upset. The muscular development showed good progress in both groups amongst those who attended regularly, but here, again, the muscles showed a more rapid increase in the whole-milk babies.

I saw some of these cases when they were 18 months old, and there were no signs of rickets in either group. Another difference was, that the whole-milk infants were sooner satisfied than the others. I may add, that these observations were made in the winter months. In hot weather, I have often had bad results, both with whole citrated, and with dilute, milk mixtures. I believe it is impossible to keep the milk from becoming contaminated in the home during the summer time, and, therefore, I put all the children on a dried full cream milk, while the warm weather lasts. This plan has been most successful, and it has had a marked effect in diminishing the death-rate of the infants attending the Consultations; this,

however, is not the only result, for it has also reduced the sickness rate. The dried milk is sold cost price to the mothers, and, practically, it proves to be a little cheaper than cow's milk, because there is no waste. I note that the advocates of whole-milk feeding are agreed that it should be stopped in cases of summer diarrhoea, but, surely, it would be better to eliminate whole citrated milk altogether from the diet at the commencement of the warm season rather than to run so great risk. In the case of large towns, I consider this risk to be a great disadvantage to the routine use of citrated milk.

When constipation occurs in whole-milk feeding it can often be relieved by increasing the amount of milk. If, however, as sometimes happens, the milk is increased to the utmost degree of tolerance, and still the constipation is not relieved, we have a condition produced which is much more obstinate than in any other form of feeding. I find that in these cases it is better to change the diet rather than to give large doses of paraffin.

I should like to mention another condition, in which whole milk often accentuates a tendency to constipation. When inquiring into the history of a case it is not at all uncommon to hear that the child received a dose of castor oil on the third day of life, and that in order to overcome the resulting constipation, subsequent doses of one teaspoonful were given every three days, for a month or more. The injury which results from this drastic treatment must be repaired before the bowel can recover its normal function, and I do not find that whole milk is a suitable food in these cases, until the tendency to constipation, which is a natural sequel to this form of injury, has been cured.

When a child has been fed on diluted cow's milk during the first fortnight of life, has never had breast milk at all, and there has been no attempt to imitate the colostrum period, there is usually an intolerance for cow's milk, and these cases are seldom suitable for whole-milk feeding.

It is a curious fact that during the last few years I have seen far fewer cases of wasting than I did formerly. The excellent system of visiting, both official and voluntary, under the Notification of Births Act, has enabled us to give advice on questions relating to diet and general hygiene at the earliest possible moment. The mothers in the neighbour-

hood are now willing to have their children under medical supervision in order to keep them well. I see a large number of breast-fed infants who are not progressing favourably, and it is most important in these cases to find out the cause. Women are often told by their friends, and even medical men, to put the child on the bottle "as the breast milk does not suit it." In cases in which it is merely a question of insufficient supply, small supplementary feeds of cow's milk, diluted or undiluted, given directly after the breast is all that is required, and the mother can continue to feed her child in this manner for many months. As the breast milk diminishes, so the quantity of cow's milk should be increased, and in this way the child passes through the weaning period with no trouble.

The other day, I saw a case of a child who was being fed on cow's milk, and doing badly; the mother had been told to discontinue breast-feeding, as the infant was not satisfied, so for six weeks she had given it no breast milk. I at once put the child to the breast, and found, by weighing before and after the feed, that it obtained $2\frac{1}{2}$ oz. I told the mother to persevere with breast feeding, and to give small quantities of dried milk, one teaspoonful to three tablespoonfuls of water after each breast feed. The child did remarkably well. At the present moment the great majority of infants are being fed on this combined method. I feel sure that if this plan were more generally adopted by the profession, artificial feeding, with all its attendant dangers, would not be so frequent. It is of the greatest importance to make full use of every ounce of breast milk, even when most of the diet has to be artificial. Infants do better when they have variety in their diet, and for this reason we cannot get the best results on any routine method of feeding. At these regular weekly Consultations the physician has a greater opportunity of studying the effect of a particular diet than at a hospital out-patient department, where the attendance is often very irregular. I have often been struck by the fact that, when a child has been fed on the same diet for some months, a stage is reached when no progress takes place until some variety in the food is introduced. It seems to me that a physician who is in charge of an Infant Consultation should make himself acquainted with every possible mode of feeding.

NOTES ON SOME RECENT OBSTETRICAL AND GYNÆCOLOGICAL CASES AT THE LONDON HOSPITAL.

By R. DRUMMOND MAXWELL, M.D., F.R.C.S.

*Physician to Queen Charlotte's Lying-in Hospital; Assistant Obstetric
Physician and Lecturer in Midwifery, London Hospital;
Examiner to the Midwives Board, etc.*

[With Plates III. and IV.]

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I OFFER no apology for these apparently disconnected notes, for to anyone who has had experience of hospital staff work during the last year, the stress of that service, for the most part deprived of regular assistance, is a remembrance that will not easily be forgotten, and the strain is by no means over yet. Still, I thought it well to put on record a very few of the more interesting cases met with at a time that necessitated daily visits (and many nightly ones) to the hospital. To those who helped me in that work, I would pay tribute—to the nursing staff, for their unremitting care and devotion to the patients in their charge; to my residents, who have since mostly regained their health by a sojourn in Flanders; and, lastly, to the most loyal assistance of my clerks, several of whom had already served as probationer-surgeons in the Navy, and who came back with a remarkable store of acquired responsibility which augurs well for their future.

I. INJURIES TO THE BLADDER IN LABOUR AND THEIR REPAIR.

Immediate rupture of the bladder, either extra or intra-peritoneal, occurring as a result of instrumental deliveries, is one of the rarest of obstetric injuries. I have only met with one such case in the last eight years of the records at

hood are now willing to have their children under medical supervision in order to keep them well. I see a large number of breast-fed infants who are not progressing favourably, and it is most important in these cases to find out the cause. Women are often told by their friends, and even medical men, to put the child on the bottle "as the breast milk does not suit it." In cases in which it is merely a question of insufficient supply, small supplementary feeds of cow's milk, diluted or undiluted, given directly after the breast is all that is required, and the mother can continue to feed her child in this manner for many months. As the breast milk diminishes, so the quantity of cow's milk should be increased, and in this way the child passes through the weaning period with no trouble.

The other day, I saw a case of a child who was being fed on cow's milk, and doing badly; the mother had been told to discontinue breast-feeding, as the infant was not satisfied, so for six weeks she had given it no breast milk. I at once put the child to the breast, and found, by weighing before and after the feed, that it obtained $2\frac{1}{2}$ oz. I told the mother to persevere with breast feeding, and to give small quantities of dried milk, one teaspoonful to three tablespoonfuls of water after each breast feed. The child did remarkably well. At the present moment the great majority of infants are being fed on this combined method. I feel sure that if this plan were more generally adopted by the profession, artificial feeding, with all its attendant dangers, would not be so frequent. It is of the greatest importance to make full use of every ounce of breast milk, even when most of the diet has to be artificial. Infants do better when they have variety in their diet, and for this reason we cannot get the best results on any routine method of feeding. At these regular weekly Consultations the physician has a greater opportunity of studying the effect of a particular diet than at a hospital out-patient department, where the attendance is often very irregular. I have often been struck by the fact that, when a child has been fed on the same diet for some months, a stage is reached when no progress takes place until some variety in the food is introduced. It seems to me that a physician who is in charge of an Infant Consultation should make himself acquainted with every possible mode of feeding.

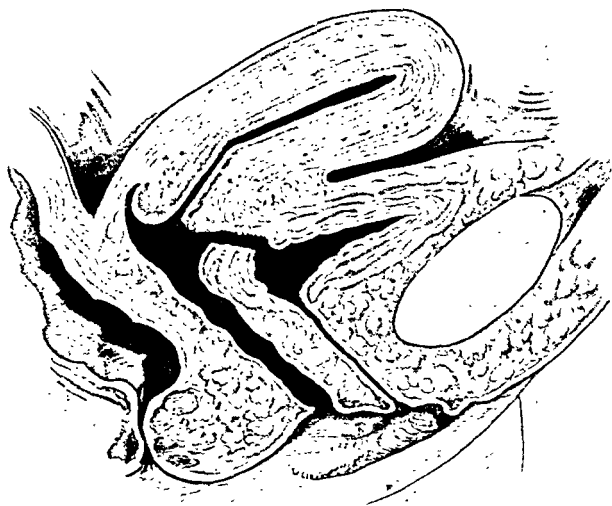


Fig. 1.—*Vesico-cervical fistula. The anterior lip of the cervix has sloughed off.*



Fig. 2—*Laparotomy. Stage 1. Vesico-uterine peritoneal fold incised. The bladder stripped down exposing the fistulous track from above.*

the London Hospital. The immediate cause in this case was undoubtedly due to a failure to appreciate the obstetric maxim that all manual and instrumental manipulations in labour must be preceded by the use of the catheter.

The patient had been admitted to the hospital with an occipito-posterior presentation impacted in the pelvis. In addition, the foetus had probably been dead for several hours. The resident had been guilty of two serious errors. He had neglected to pass the catheter, and had not used the stethoscope to appreciate the value of the foetal factor, the result being that, immediately after delivery of a dead child (unreduced in size), the patient's urine contained a large amount of blood. Œdema above the pubes soon proved that there was an extravasation of urine. Lateral incisions were made in each groin and a median incision above the pubes, within twenty-four hours of the delivery. The finger introduced above the pubes demonstrated the most widely spread extravasation of urine, opening up cellular tissue planes laterally to the wall of the pelvis, and involving also the paravaginal cellular tissue. Infection of these areas set in, and the patient died on the third day of a widely spread hæmorrhagic and sloughing pelvic cellulitis.

Such cases are uncommon. More frequently, an immediate laceration of the bladder follows a rupture of the lower uterine segment, consequent on a forceps extraction or an internal version faultily performed.

I have known the bladder directly ruptured in a case of placenta prævia, where the expulsion of a De Ribes's bag, somewhat bigger than the official diameter (4 inches) at its upper pole, led to a tear of the lower uterine segment, in which the bladder shared.

The repair of this tear was a lengthy and tedious process, involving four separate attempts before its closure was finally effected. Much cicatricial contraction resulted, though not sufficiently to prevent a later pregnancy.

The recollection of the difficulty of repair of this fistula influenced me strongly to terminate this second pregnancy at full term by Cæsarian section, owing to the presence of so much scar tissue and a fear that the bladder might again suffer.

I have, on several occasions, performed Cæsarian section

owing to the presence of scar tissue the result is pressure injuries or lacerations associated with difficult deliveries. It is remarkably, however, how frequently such scar tissue will soften and stretch in the later weeks of pregnancy, and an extensive anastomosis up to the case of labour should, therefore, be adopted in such cases.

It is, however, in connection with the difficult injuries of the bladder (the consequence of sloughing of some part of the birth canal, vaginal or cervical) that I wish to call special attention.

With the commoner vesico-vaginal fistula I am not so much concerned as with the more difficult vesico-cervical variety. With the former the probability of exposure of the fistula from below is greater and, though cicatricial contraction may render such exposure very difficult still, on the whole, repair can eventually be achieved, provided always freeing the edges of the fistula from the scar tissue is carried out as a preliminary stage.

The cervico-vesical fistula, however, introduces two fresh difficulties: inaccessibility to the fistula from below, and the necessity of maintaining the patency of the cervical canal. In many of these cases, too, the anterior lip (sometimes also the posterior) of the cervix has disappeared, and there is therefore, no means of dragging down the upper part of the vagina into view. To attempt repair of a fistula from below, in these circumstances is not wise or profitable, and it is largely to call attention to their ease of approach and repair by the abdominal route that I write this short note on the subject.

In the last edition (1913) of *Diseases of Women* (Herman and Maxwell), pp. 681-691, I called attention to this type of operation, which I had found immediately successful in a case in which three previous failures to close the fistula from below had occurred, each vaginal operation simply resulting in the formation of denser cicatricial tissue. The steps of the operation are there fully described, and the illustrations in this article (Figs. 1-4, Plates III, and IV,) are those in the original article.

The experience of this type of fistula repair, quoted in *Diseases of Women*, was based on one case; but lapse of time has provided me with two fresh opportunities of confirming

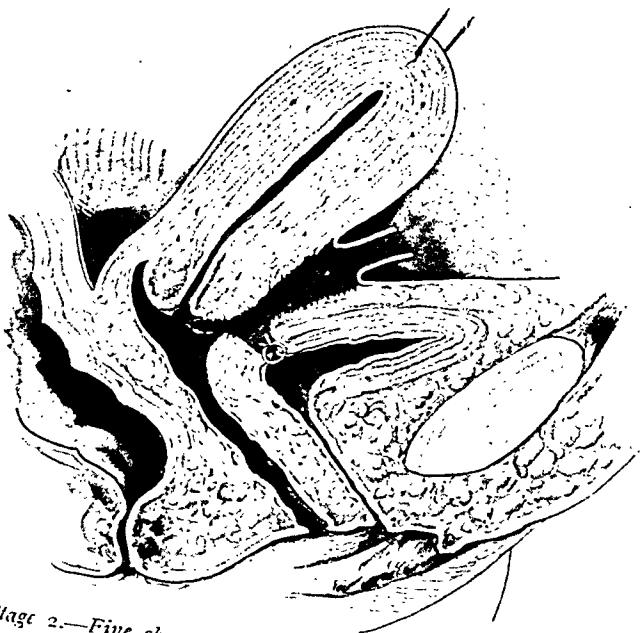


Fig. 3.—Stage 2.—Fine chromic catgut interrupted sutures (4) approximating the edges vesical mucosa.

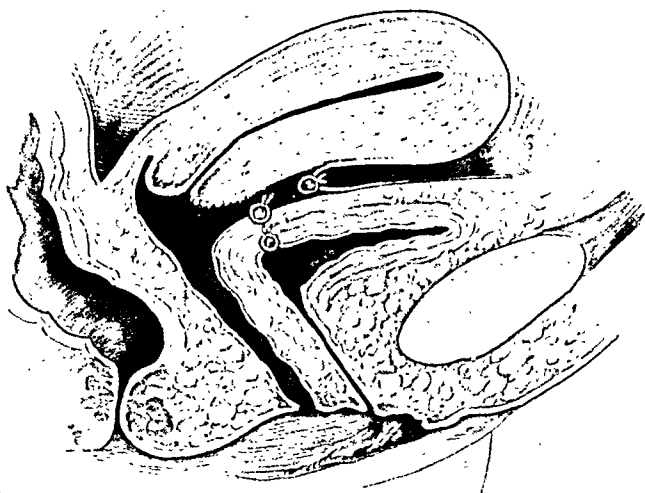


Fig. 4.—Stage 3.—Insertion of a superposed tier of catgut sutures through bladder muscle. Closure of vesico-uterine peritoneal fold. Operation concluded. Direct drainage into vagina of repaired area.

owing to the presence of scar tissue, the result of previous injuries or lacerations associated with difficult embryotomies. It is remarkable, however, how frequently such scar tissue will soften and stretch in the later weeks of pregnancy, and an expectant attitude up to the onset of labour should, therefore, be adopted in such cases.

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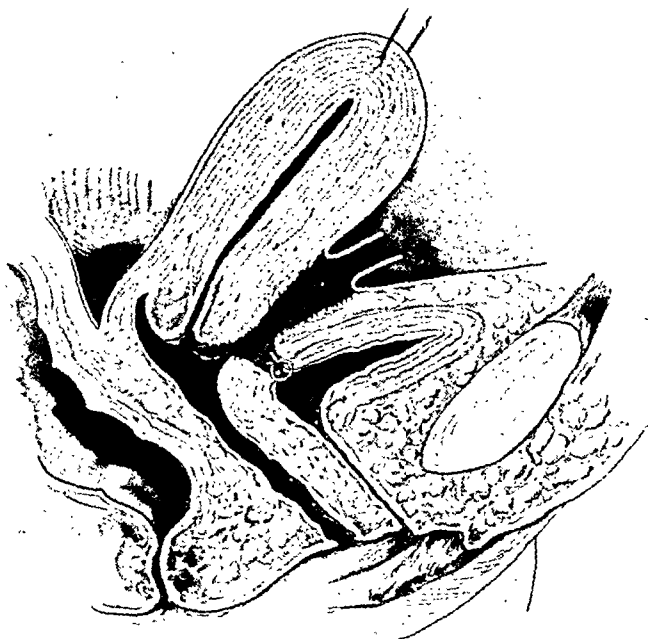


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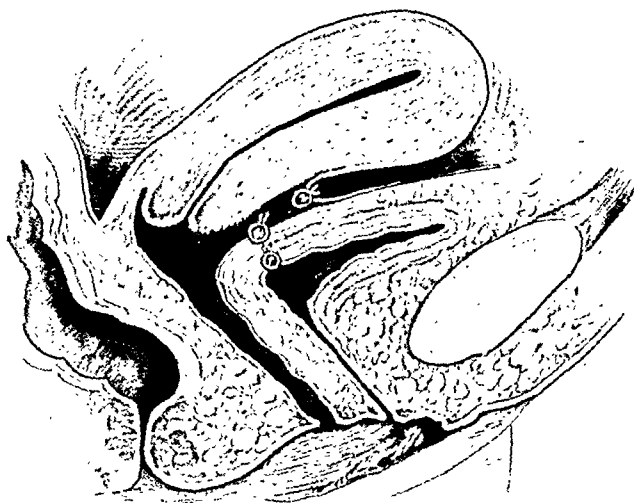


Fig. 4.—Stage 3.—Insertion of a superposed tier of catgut sutures through bladder muscle. Closure of vesico-uterine peritoneal fold. Operation concluded. Direct drainage into vagina of repaired area.

- (2) If there be a large degree of vaginal cicatrization,
- (3) If several previous attempts at repair from below have failed,
- (4) If the fistula be antero-lateral, in the vicinity of the ureteric orifices,

the ideal method of approach is the supra-pubic route.

There remains the special point as to whether the operation, viewed from the standpoint of subsequent parity, should be conservative or not.

In the last case quoted, the age of the patient was over 40; there were two children. The maintenance of the cervical canal, or at least a passage from the uterus to the vagina, was felt to be undesirable, owing to the wish to fix the repaired area as firmly as possible to the posterior wall of the cervix. This could only be done if the uterus were removed. The patient readily consented to its removal, and this sub-total hysterectomy, as a preliminary stage, added greatly to the ease of the operation. I do not recommend it as essential, except in those cases in which the anterior lip of the cervix has sloughed. If there be little damage to the anterior lip, the bladder may as easily be fixed back on the anterior wall of the supra-vaginal cervix, but there will always be the difficult question of drainage of the anterior parametric space under the utero-vesical peritoneal fold.

Where the uterus has been spared in these circumstances, or a successful repair from below of a vesico-vaginal fistula has been effected, what should be the attitude of the obstetrical surgeon to a subsequent pregnancy and labour? This will depend considerably on the primary causes of the original fistula, such as pelvic contraction or the faulty management of the previous labour, or injudicious instrumental extraction. The former condition—pelvic contraction—of course still persists, and may suggest safer means of delivery by induction of premature labour or by Cæsarian section at full time. The scar tissue, which will almost inevitably result from these operations for repair of fistula, will certainly interfere with the normal upward displacement of the bladder in the first stage of labour, besides leading to a certain degree of stenosis of the birth canal. In these circumstances, I should lay down the rule that the patient should never again be allowed to run the least risk of a second injury

this original experience, and, in both cases, the closure of the fistula was immediate and final.

In the last case of the series, which I record fully, the technique differed to the extent that repair of the fistula was preceded by a sub-total hysterectomy. The patient was 40 years of age; there were two children. The embarrassment and complete social disqualification of the patient for two years had rendered her life miserable to the last degree. Several operations had been performed unsuccessfully—one in Lisbon, and the second in Newcastle. The absence of an anterior wall to her cervix deprived the bladder of any solid *point d'appui* which could serve as a "backing" to the repaired fistula. There remained the posterior wall of the cervical canal, but it could not be used for this purpose without occluding the cervical canal below a functioning uterus with regular menstrual loss. For these reasons, with the patient's consent, I removed the body of the uterus.

The cervical stump, mainly consisting of its posterior portion, was firmly grasped by a volsellum forceps, and the lower portion of the bladder freed from the anterior wall of the cervical canal and upper half-inch of the vagina. This freeing of the bladder was easily effected by swab pressure, and the fibrous greyish white edges of the fistula exposed. Some momentary doubt existed whether the fistula seen was the pre-existing one or a fresh one made during the slipping down of the bladder. Its fibrous edges and the absence of bleeding convinced one, however, that it was the sole opening into the bladder. The orifice itself was little bigger than the head of a large pin, and explained an interesting circumstance in the history that there was little incontinence in the erect position (only after 4-5 hours' accumulation of urine), but almost invariably in the recumbent position, since the opening then formed the lowest point of the bladder. Clinical signs of frequency and pain on micturition were never present. The patient left the nursing home cured three weeks after the operation, being able to retain urine comfortably for six hours in the horizontal or erect position without any ill-effect.

The points I would emphasize, therefore, in connection with this subject are:—

- (1) If a fistula be difficult of access from below,

- (2) If there be a large degree of vaginal cicatrization,
- (3) If several previous attempts at repair from below have failed,
- (4) If the fistula be antero-lateral, in the vicinity of the ureteric orifices,

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to her bladder, and Cæsarian section should, therefore, be recommended as the sole method of delivery. I have followed this ruling in two cases, quoted above, in both of which I had found the repair of the fistula from below most tedious, and requiring several operations.

2. OBSTETRIC MUTILATIONS.

There are admitted into the London Hospital a considerable number of cases in which the lower genital tract, cervix, vagina, and perineum are lacerated and bruised to an almost inconceivable extent. One would almost infer, from inspection of these cases, that the accoucheur had set out to inflict deliberately the maximum injury consistent with survival, and been thoroughly successful in his aim.

Why, in this branch of medicine, should there be seen so often such tragic illustrations of complete lack of judgement on the part of the accoucheur? The same practitioner would never dream of operating on a strangulated hernia in his practice. What strange optimism leads him, therefore, to practise interventions, fraught with an equally high degree of risk, and, above all, to persist in these interventions long after it is obvious that they are of no avail? I am bound to say that I do not find the notable improvement that might be expected to follow the better teaching in recent years of clinical obstetrics, and I expect one will have to wait a few years longer before that teaching bears fruit. Certainly, the number of mutilated cases one sees is most disheartening, and constitutes a grave indictment against much of the midwifery of the present time.

It is perfectly obvious, too, that amongst the poorest classes the septic environment of the patient, the low rate of remuneration of the medical man, together with the incessant calls on his time, all make it very doubtful if it is in the national interest that the present system should prevail.

The ideal one would like to attain to (and it is not beyond reach) is the extension of the Infirmary service to include much more of this class of midwifery in its province than is at present possible. Every case in this class of life would be delivered in the local district lying-in ward, and, if normal, sent back, by ambulance, to her home in 24 hours' time, subsequent attention and visits being carried out by a

nursing staff under the supervision of an obstetrical officer of experience.

As an instance of grave instrumental injury, let me quote from the notes of a case seen within the last six months. The patient, a primigravida, was delivered two days before I saw her. The social circumstances were, I should say, favourable, the surroundings clean, those, in fact, of a small house, with a rent of, approximately, 50*l.* per annum. I mention these details to emphasize that these errors of judgment are in no way limited to the midwifery of the poorest classes.

The patient had a temperature of 104°, a pulse of 140, and was lying in a condition resembling the "typhoid state," gravely intoxicated by septic absorption. The vaginal discharge was intolerably foul; the labia, or what was left of them, and the perineum were covered with septic blackish-green sloughs. In addition, the condition of the bladder had escaped notice; an intermittent escape of urine had deceived both medical attendant and the nurse, since about 50 ozs. of urine were retained in the bladder, and were drawn off by catheter after the most careful disinfection of the meatus. A mild anæsthetic was given to the patient with a view to discovering the full extent of her injuries. There were found, in addition to the external injury, two deep tears in the lateral vaginal walls, extending into the paravaginal cellular tissue, and the finger placed in these tears appeared to be practically in contact with the ascending rami of the ischium. The vagina was hurriedly swabbed out with a solution of hydrogen peroxide, and the lacerations plugged to their depths with sterilized gauze to facilitate drainage. The prognosis I gave was of the gravest, and little hope of the patient's survival was held out. The next morning, the patient's condition, not actively contra-indicating her removal, I had her transferred to the puerperal ward in the isolation block at London Hospital. The case appeared clinically to be of the severest type of septicæmia, though no streptococcus was actually recovered from her blood by Dr. G. T. Western, to whose valuable work this department has long been indebted. The gauze drainage was re-applied daily for the first four days under anæsthesia, and local disinfection carried out with hydrogen peroxide. The patient

to her bladder, and Cæsarian section should, therefore, be recommended as the sole method of delivery. I have followed this ruling in two cases, quoted above, in both of which I had found the repair of the fistula from below most tedious, and requiring several operations.

2. OBSTETRIC MUTILATIONS.

There are admitted into the London Hospital a considerable number of cases in which the lower genital tract, cervix, vagina, and perineum are lacerated and bruised to an almost inconceivable extent. One would almost infer, from inspection of these cases, that the accoucheur had set out to inflict deliberately the maximum injury consistent with survival, and been thoroughly successful in his aim.

Why, in this branch of medicine, should there be seen so often such tragic illustrations of complete lack of judgement on the part of the accoucheur? The same practitioner would never dream of operating on a strangulated hernia in his practice. What strange optimism leads him, therefore, to practise interventions, fraught with an equally high degree of risk, and, above all, to persist in these interventions long after it is obvious that they are of no avail? I am bound to say that I do not find the notable improvement that might be expected to follow the better teaching in recent years of clinical obstetrics, and I expect one will have to wait a few years longer before that teaching bears fruit. Certainly, the number of mutilated cases one sees is most disheartening, and constitutes a grave indictment against much of the midwifery of the present time.

It is perfectly obvious, too, that amongst the poorest classes the septic environment of the patient, the low rate of remuneration of the medical man, together with the incessant calls on his time, all make it very doubtful if it is in the national interest that the present system should prevail.

The ideal one would like to attain to (and it is not beyond reach) is the extension of the Infirmary service to include much more of this class of midwifery in its province than is at present possible. Every case in this class of life would be delivered in the local district lying-in ward, and, if normal, sent back, by ambulance, to her home in 24 hours' time, subsequent attention and visits being carried out by a

proposed later to approach the bladder from above, and, failing exposure of the fistulous track, to turn the ureters into the large bowel.

The patient and her relatives were, however, averse to this operation, and she left the hospital with a permanent fistula and an obliterated vagina. The details of the labour, or such as I have been able to gather, point to the fact that impaction of the head in the pelvis for many hours played as large a part in the causation of the fistula as the subsequent craniotomy; but, in any case, the final result has been the unsexing of the patient.

What is the moral to be learnt from this calamitous obstetric record? Simply this—that a combination of lack of experience and judgement, lack of adequate time to devote to a midwifery case, and a mistaken sense of pride in refusing to take advantage of skilled advice which is nowhere remote in the London area, still renders some of our metropolitan midwifery a blot on the reputation of modern obstetrics.

3. FIBROIDS COMPLICATING PREGNANCY.

The next case I describe illustrates a rare complication of fibroids during pregnancy and labour. Its termination is, fortunately, happier than the previously recorded cases.

The patient was sent to hospital about the fourth month of pregnancy with symptoms of acute pain in the right iliac fossa and signs pointing to a localized appendix abscess.

The abdomen was opened, and a large matted mass of bowel—mainly transverse colon and omentum—found adherent to the uterus. A search was made for the appendix, but, as it was not easily found, and the condition appeared to be a gynæcological one, the abdomen was closed, without disturbing the adhesions.

I saw the patient later when she was transferred to the gynæcological ward, and felt there was little doubt of the existence of a pedunculated fibroid as large as a tennis ball at the right cornu. The train of events seemed easily accounted for, by necrobiotic changes taking place during pregnancy, the degeneration approaching the capsule of the fibroid and leading to bowel and omental adhesions. The acute symptoms subsided, and the patient was kept under observation for the remainder of her pregnancy, which was uneventful. She was admitted during her last month of

made a steady recovery, and was out of danger in ten days.

Her recovery owes itself largely to the admirable nursing that characterizes the work in this septic puerperal ward.

The patient, in her fourth week, developed what appeared to be a typical right-sided parametritis; a swelling formed fully three inches above Poupart's ligament, obviously in the right parametrium, and threatened to point above the ligament. Experience has taught me to delay in opening deep inflammatory swellings in the parametrium, and this swelling proved no exception by undergoing complete resolution in another three weeks. The patient left the hospital after seven weeks in bed. Her pelvic floor moved well; all induration had cleared up in the right broad ligament. The sole evidence of her injuries lay in a slight stenosis of the vaginal orifice, which must, of course, be kept under observation lest a greater degree of contraction ensue.

Recovery is a rare termination in this type of case.

Another local (East End) labour case lay in the wards at the same time. The patient was an enormously stout Jewess, rendering vaginal examination difficult. She was admitted following a craniotomy for a very slight degree of pelvic contraction. The vulvo-perineal area was severely bruised and lacerated; the sphincter ani, fortunately intact, was exposed at the posterior margin of the tear. No attempt was made at immediate repair, for such attempts can hardly ever be successful when carried out on bruised and sloughing tissues. Three days after delivery, large sloughs were detached from the vaginal wall, and heralded the establishment of a large vesico-vaginal fistula; the whole of the floor of the bladder seemed to have disappeared. Local disinfection remained the only form of treatment that could be carried out till the maximum healing had taken place. The vagina was irrigated three times daily with a hypertonic saline solution, which is undoubtedly the best for local application in these cases.

I did not examine the patient again till three weeks had elapsed, and the parts were approximately healed; under anæsthesia, the vagina now admitted barely one finger, and had contracted down to a *cul-de-sac* about $1\frac{1}{2}$ ins. in length, and a narrow channel at the top led direct to the bladder. The scar tissue was extremely dense; approach to the bladder from below was practically out of the question. I

patient (three cases), but up to five sections have been performed on the same patient before her final sterilization.

The other point of interest raised is in connection with the suture material used. Roughly, three types of suture have been in general use—silk, silkworm gut, and catgut (iodized or chromicized). While silk remained the classic suture, the best modern results recorded in this operation were obtained by the use of silkworm gut in the hands of Dr. Gow, and many obstetric surgeons, who, as R. M. O.s to Queen Charlotte's Hospital, knew his work there, will never forget the soundness of his teaching, and how much the modern operation owes to his simple and perfect technique.

Silkworm gut, however perfectly aseptic a suture it may be, has certain mechanical disadvantages in this operation, which may be seen in a later repeated Cæsarian section. Some mechanical irritation of the uterine peritoneum is produced inevitably by virtue both of its permanence and the ends of the knot, however short they be cut. A thin filmy organized fibrinous layer forms over the scar, and beneath this the suture knots can easily be felt. This organized layer occasionally becomes adherent to the parietes, and adhesions may form between uterus and parietes. Adhesions may also form between the anteverted anterior scar-bearing surface and the roof of the bladder, and, under the influence of a later pregnancy, a thick fleshy tag, running between the bladder and the former scar, is seen. I do not know of any case in which this elongated adhesion has complicated either the subsequent pregnancy or the operation, though I have often met it, as well as the rarer omental adhesions from above which are embarrassing, solely from their hindrance to extraction of the incised uterus for the purposes of removing the placenta and suturing the emptied uterus.

Reflection on these complications, and an increasing personal tendency in the last three years to use catgut where I had previously employed silk or linen suture, led to my use of stout iodine catgut in about the last twelve Cæsarian sections I have performed, and though the previous Cæsarian sections in the two cases I am about to record are not of my series, it has influenced me very strongly against the future use of catgut in this operation.

Considerations, too, on the physiology of the puerperal uterus make it certain that much of the process of involution

pregnancy to await labour. This was easy and spontaneous, and the involution of the uterus enabled one to detect with greater ease the fibroid at the right cornu.

Ten days after labour the abdomen was opened. I found the commencement of the transverse colon and omentum firmly adherent over the fibroid; on separating the bowel and omentum from the fibroid, a cavity in the latter, with ragged eroded edges, appeared, and from it escaped about a teaspoonful of pultaceous matter resembling pus, but, in reality, disintegrating degenerated fibroid tissue. One feared a communication between the lumen of the bowel and the cavity in the fibroid, but the corresponding opening on the bowel side proved to be a collection of *débris* from the fibroid, localized in the omentum; careful search failed to establish a direct communication with the bowel. The cavity in the omentum was dissected out, and a double tier of Lembert's sutures placed in the inflamed wall of the colon closest the collection, in case a narrow track led to the bowel lumen. The fibroid was enucleated easily from the uterus, and the appendix, little altered and lying remote from the adherent area, was removed.

The patient's convalescence was uneventful. There is little doubt that discharge of the fibroid *débris* into the bowel would soon have taken place, or the fibroid have become infected from the bowel, probably necessitating resection of bowel. The enucleation of the fibroid at the fourth month of pregnancy after separation of the adhesions (which, at that period, were of recent formation), would have been not only easy, but the correct treatment.

4. CONSERVATIVE CÆSARIAN SECTION.

Rupture of a Cæsarian-section scar at full term 15 months after previous operation.—This case raises several points of great interest in connection with Cæsarian section, and more particularly with conservative sections, of which an increasing number is performed yearly. No modern operator will willingly sterilize his patient after her first Cæsarian section, since the death of the infant will render her childless, if the technique of sterilization has been efficiently carried out.

The result is that we yearly see an increasing number of second or even third Cæsarian sections performed on patients. I have never done the operation more than twice on the same

hurriedly clamped, and the unemptied uterus removed at a level just short of the vaginal insertion. The patient suffered very little shock, and made a rapid recovery. But for the partial reinforcement of the thin and eroded scar tissue by omental adhesions, that had recently formed as the placenta approached the surface, the patient would hardly have survived the initial tear, and would have bled to death before reaching hospital.

As to how long an interval should precede a second pregnancy after Cæsarian section, one can make no definite pronouncement. Several of my cases have occurred within a year and a half. If the case be a "clean," deliberate, aseptic, Cæsarian section, I should therefore recommend that silk or linen suture be used, while, if aseptic conditions (intra-uterine) cannot be guaranteed, it will be wiser to use catgut and efficiently sterilize the patient. I add the word "efficiently" deliberately, for many of the methods practised to attain this object fail in their purpose. There is one object only that must be secured: complete occlusion of the proximal end of the tube beneath the peritoneum, either along its length or at its cornual insertion, where it may be treated exactly as an appendix stump and, like it, buried beneath the peritoneum.

Since writing the above, I have come across another case of rupture of a Cæsarian scar at full term. This case had been operated upon over a year before for eclampsia. Catgut sutures had been used at the previous operation. The patient, on admission, presented the appearance of intra-peritoneal hæmorrhage, and appeared to be on the verge of death.

In addition, a foetal limb was palpated with remarkable distinctness through the parietes; on opening the abdomen, the scar was found to have yielded through the whole of its extent, and the child to be lying almost wholly in the peritoneal cavity. A rapid, subtotal hysterectomy was carried out. The patient rallied, the pulse improved for a few hours, but collapse and shock set in again, and death occurred in eight hours. Out of a large number of intra-peritoneal hæmorrhages I have met with (mostly, of course, tubal ruptures), this is the first patient I have lost who left the operating table with an appreciable pulse, and her death was a grave disappointment, as well as a strong indictment of

is brought about by autolysis of muscle cells by local cell ferment action; one is inserting an easily absorbable animal tissue into an area characterized by the presence of most powerful digestive and disintegrating substances. It is on these grounds, therefore, that I hold that catgut is an inappropriate suture, and I think the following cases demonstrate it.

The patient, aged 33, was admitted to London Hospital a few days before full term, having been under observation on several occasions during the pregnancy. The abdominal scar was sound, and a reference to the notes of the previous Cæsarian section, one year before, showed a normal aseptic recovery. Everything in the notes points to a clean first intention uterine wound.

A few hours before admission the patient had complained of severe abdominal pain followed by fainting. She was actually able to walk to hospital. Her pallor had increased remarkably under the next hour's observation, when I first saw her. Her appearance at once suggested grave internal bleeding, and concealed accidental hæmorrhage was diagnosed, in spite of the fact that the uterus did not present the typical features of that complication. Before, however, dismissing the diagnosis, I separated the membranes round the internal os, and ruptured them to make sure no blood was pent up in the uterus, for the shock and collapse in some of these cases is disproportionate to the amount of blood lost. The foetal heart was not heard on repeated observations since admission of the patient. No intra-uterine bleeding was detected, and an intra-peritoneal hæmorrhage diagnosed. The abdomen was opened at once and confirmed this. The hand swept over the surface of the uterus detected at once some irregularity of the surface on its anterior wall, high up near the fundus. The incision in the parietes was enlarged to about 8 ins., and the pregnant uterus everted. At the lower edge of the thin, almost translucent, scar of the previous operation was seen an area, roughly the size of a five-shilling piece, where the scar had yielded and placental tissue was exposed, while a small area of extra-placental chorion could be seen at the upper angle of the wound. Since the foetus was certainly dead, I considered the quickest and safest method of treatment was to arrest all further bleeding at once. The two ovarian and both uterine arteries were

hurriedly clamped, and the unemptied uterus removed at a level just short of the vaginal insertion. The patient suffered very little shock, and made a rapid recovery. But for the partial reinforcement of the thin and eroded scar tissue by omental adhesions, that had recently formed as the placenta approached the surface, the patient would hardly have survived the initial tear, and would have bled to death before reaching hospital.

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fibroid, but equally to leave behind a uterus worth preserving. I have never been impressed with the wisdom of those operators who, after an hour's toil, succeed in dragging out piecemeal, through a cervical canal dilated to the calibre of the index finger, a clean, undegenerated, uninfected fibroid, which may be of any size between a tennis ball and a foetal head.

The bruising and shock to the patient are not inconsiderable, while, in a patient already ensanguinated by uterine hæmorrhages, risks of pelvic thromboses are not unknown.

In a case met with recently at the London Hospital, a woman, aged 33, after eight years' sterile married life, was admitted with a fibroid halfway up to the umbilicus. Size alone would have ordinarily warranted a hysterectomy, but for the desire, at all costs, to preserve the chance of parity.

Inspection of the uterus, after opening the abdomen, showed the fibroid to lie wholly in the posterior wall of the uterus, the fundus of which was little altered, the relations of the three structures at each cornu remaining symmetrical and undistorted. A median longitudinal incision, 5 ins. in length, was made over the posterior aspect of the tumour; on shelling the fibroid from its capsule, the endometrium at the top of the cavity was exposed, and, on inserting the finger into the cavity, it was clear that a large area of the fibroid was submucous in the posterior wall; enucleation would, therefore, have removed the whole of the posterior wall of the cavity. Recognizing this, I shaved off the fibroid with a scalpel from its anterior surface, where it had an endometrical covering, taking care to leave the endometrium with some blood supply from the fibroid; that is, I left a film of fibroid about one-third of an inch thick adherent to the endometrium. The hole in the upper part of the cavity I closed with catgut, and approximated the edges of the uterine incision as in an ordinary myomectomy. The patient bled somewhat freely from below for several days, but this soon ceased, and before her discharge, a sound determined the existence of a uterine cavity, and several normal menstrual periods have since occurred. It is to be hoped that this conservative myomectomy may be rewarded by a later pregnancy, for examination of this patient four months later shows the presence of a uterine cavity at least 3 ins. long, and menstruation, formerly acutely painful, is now normal.

catgut suture.

5. CONSERVATIVE MYOMECTOMY.

Myomectomy, always the operation of choice for the treatment of uterine fibroids, provides the surgeon with disappointingly few opportunities of practice, as compared with the much more frequent subtotal hysterectomies which are forced reluctantly on him, both by the multiplicity of the fibroids and their embarrassing situation as regards the appendages. All conservative surgeons are familiar with the uterus moderately enlarged, which invites "enucleation" of its interstitial fibroid tumours. First, one is shelled out, then another, a third is discovered and removed, and possibly a fourth. At this stage, the surgeon begins to doubt if preservation of such a mutilated organ is judicious, and settles the question by a hysterectomy. All gynæcologists who aim at a conservative ideal have faced this situation, while, to those who are unfamiliar with it, this note will not in any way appeal.

Again, during the course of a "myomectomy" (abdominal enucleation of a fibroid), the uterine cavity is occasionally exposed. Up till recently, I have always regarded this incident as contra-indicating the operation, and ended it at once by a hysterectomy. Subsequent reflection on the generally aseptic state of the endometrium has convinced me that this exposure of the cavity does not warrant in every case the abandonment of the myomectomy and call for hysterectomy. It is important to appreciate both the extent and site of encroachment of an interstitial fibroid in the uterine cavity. This can only be accurately determined by two prior investigations. First, digital exploration of the cavity to determine how much such a fibroid projects into it; and, secondly, inspection of the fibroid from within the abdomen to determine, by the relation of fundus and round ligaments, whether the fibroid lies in the anterior or posterior wall, a point which cannot possibly be determined with certainty by a bimanual examination. One may say approximately that, if more than half the volume of the fibroid project into the cavity, it must be, to a large extent, polypoid, and, within limits, be removable from below. If a good deal less than half its volume project within the body, such an interstitial growth will not easily be removed from below without much associated injury to the uterus; for the object of the operation is not surely solely to remove the

fibroid, but equally to leave behind a uterus worth preserving. I have never been impressed with the wisdom of those operators who, after an hour's toil, succeed in dragging out piecemeal, through a cervical canal dilated to the calibre of the index finger, a clean, undegenerated, uninfected fibroid, which may be of any size between a tennis ball and a foetal head.

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about a week or ten days after the performance of the radical operation.

Since that time, many suggestions have been made as to how and when the graft should be applied, and some of these different methods may be mentioned.

Ballance's original method was to cut a large Thiersch graft 3 ins. by 2 ins. from the inner part of the thigh, and, by means of a large section lifter, similar to that used in the making of microscopic slides, to transfer this to the mastoid cavity. By the use of a glass pipette, the graft was then sucked into position so as to line accurately the whole cavity, a second smaller graft being applied to the soft parts behind the ear, and one end brought through the meatus. This graft was made to cover the raw surface of the posterior meatal wall, from which the concho-meatal flap had been cut. Gold leaf or some other form of protective was then applied to the surface of the graft, and small sponges, with a strip of gauze, were inserted to keep the graft in position.

As a modification of this method, Milligan proposed "to fill the mastoid cavity with normal salt solution, floating the graft upon the fluid, and then sucking up the fluid *per meatum* with a large pipette. As the fluid is withdrawn, the graft sinks into the cavity, and ultimately comes to lie in accurate apposition with its granulating walls." (*Diseases of the Ear*, by Milligan and Wingrave, p. 338.)

Another method is to use, instead of a lifter, a piece of crape tissue upon which the graft, with its cut surface facing upwards, is carefully spread. The crape is then gathered up and, with the graft still clinging to it, is inserted into the operation cavity by way of the auditory meatus, and, with the aid of a probe, spread over its walls.

In 1903, I saw Politzer employ the following method, so as to avoid reopening the post-aural wound. He made use of a glass tube, with a bulb at one end, in which were several small holes; a small graft, which had been cut under local anæsthesia, was placed over the end of the bulb with the epidermal surface against the glass, and after the bulb had been introduced into the ear through the meatus, the graft was blown into position. Several small grafts were employed, and the cavity was then plugged. A similar method has

SKIN GRAFTING IN MASTOID OPERATIONS.*

By H. J. MARRIAGE, M.B., B.S., F.R.C.S.

Aural Surgeon to St. Thomas's Hospital.

IN the first place, I much regret that, owing to the large amount of time which is now occupied in the treatment of the wounded, I have been unable to refer to the literature of the subject as much as I could wish. I therefore propose to deal chiefly with my own personal experiences.

As regards cases of acute mastoiditis in which the antrum and mastoid cells are opened up without any interference with the tympanum, I think it is quite evident that skin grafting is not advisable, for the object aimed at is to get free drainage and to allow the cavity formed to fill up as much as possible with granulation tissue and new bone.

The cases for which skin grafting is, in my opinion, most advantageous are those of chronic mastoid disease, and I propose to discuss the treatment of these cases by skin grafting, both primary and secondary.

As far as I can trace, skin grafting in the radical mastoid operation was first brought forward by Siebenmann, in an article in the *Berliner klinische Wochenschrift* in 1893; he suggested applying a graft some two or three weeks after the primary operation. In 1897, Denker advocated in certain cases the application of Thiersch grafts two to four weeks after the radical operation. In 1903, I saw Jansen, at the time of the original operation, applying small grafts with intervals between each piece of skin, and I believe he had been doing this for a year or more. I think, however, that the chief credit for this form of treatment belongs to Mr. Charles Ballance, who brought the subject prominently before our profession in the very instructive paper which he read before the Royal Medical and Chirurgical Society on January 23, 1900. In this paper, he recommended the application of one or more large Thiersch grafts to the cavity,

* An address delivered before the Otological Section of the Royal Society of Medicine.

about a week or ten days after the performance of the radical operation.

Since that time, many suggestions have been made as to how and when the graft should be applied, and some of these different methods may be mentioned.

Ballance's original method was to cut a large Thiersch graft 3 ins. by 2 ins. from the inner part of the thigh, and, by means of a large section lifter, similar to that used in the making of microscopic slides, to transfer this to the mastoid cavity. By the use of a glass pipette, the graft was then sucked into position so as to line accurately the whole cavity, a second smaller graft being applied to the soft parts behind the ear, and one end brought through the meatus. This graft was made to cover the raw surface of the posterior meatal wall, from which the concho-meatal flap had been cut. Gold leaf or some other form of protective was then applied to the surface of the graft, and small sponges, with a strip of gauze, were inserted to keep the graft in position.

As a modification of this method, Milligan proposed "to fill the mastoid cavity with normal salt solution, floating the graft upon the fluid, and then sucking up the fluid *per meatum* with a large pipette. As the fluid is withdrawn, the graft sinks into the cavity, and ultimately comes to lie in accurate apposition with its granulating walls." (*Diseases of the Ear*, by Milligan and Wingrave, p. 338.)

Another method is to use, instead of a lifter, a piece of crape tissue upon which the graft, with its cut surface facing upwards, is carefully spread. The crape is then gathered up and, with the graft still clinging to it, is inserted into the operation cavity by way of the auditory meatus, and, with the aid of a probe, spread over its walls.

In 1903, I saw Politzer employ the following method, so as to avoid reopening the post-aural wound. He made use of a glass tube, with a bulb at one end, in which were several small holes; a small graft, which had been cut under local anæsthesia, was placed over the end of the bulb with the epidermal surface against the glass, and after the bulb had been introduced into the ear through the meatus, the graft was blown into position. Several small grafts were employed, and the cavity was then plugged. A similar method has

SKIN GRAFTING IN MASTOID OPERATIONS.*

By H. J. MARRIAGE, M.B., B.S., F.R.C.S.

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IN the first place, I much regret that, owing to the large amount of time which is now occupied in the treatment of the wounded, I have been unable to refer to the literature of the subject as much as I could wish. I therefore propose to deal chiefly with my own personal experiences.

As regards cases of acute mastoiditis in which the antrum and mastoid cells are opened up without any interference with the tympanum, I think it is quite evident that skin grafting is not advisable, for the object aimed at is to get free drainage and to allow the cavity formed to fill up as much as possible with granulation tissue and new bone.

The cases for which skin grafting is, in my opinion, most advantageous are those of chronic mastoid disease, and I propose to discuss the treatment of these cases by skin grafting, both primary and secondary.

As far as I can trace, skin grafting in the radical mastoid operation was first brought forward by Siebenmann, in an article in the *Berliner klinische Wochenschrift* in 1893; he suggested applying a graft some two or three weeks after the primary operation. In 1897, Denker advocated in certain cases the application of Thiersch grafts two to four weeks after the radical operation. In 1903, I saw Jansen, at the time of the original operation, applying small grafts with intervals between each piece of skin, and I believe he had been doing this for a year or more. I think, however, that the chief credit for this form of treatment belongs to Mr. Charles Ballance, who brought the subject prominently before our profession in the very instructive paper which he read before the Royal Medical and Chirurgical Society on January 23, 1900. In this paper, he recommended the application of one or more large Thiersch grafts to the cavity,

* An address delivered before the Otological Section of the Royal Society of Medicine.

- (3) The patient is spared a large amount of pain, which formerly was caused by firmly plugging the raw surface of the mastoid cavity ;
- (4) Both the patient and surgeon are saved much time and trouble, for, about ten days after the grafting operation, the patient is able to do nearly all that is necessary for himself. He need only see his surgeon once a week, and is thus able to return to work much earlier than when he was obliged to attend daily for treatment ;
- (5) The surgeon is not worried by having to make complicated meatal flaps, many of which cause much deformity of the concha, and, when made, are often difficult to keep in position. All that is necessary is to remove sufficient of the posterior meatal wall to ensure easy access to the antrum and mastoid cavity.

The method I usually employ is to make an incision at the junction of the posterior meatal wall and the concha, and a second incision along the middle of the floor of the meatus, and, after cutting away some of the subcutaneous tissues, suture with catgut the flap so formed to the soft parts immediately behind the ear, so that the skin surface of the flap looks toward the mastoid cavity ;

- (6) In a large proportion of cases the Eustachian tube is closed, and reinfection *viâ* the tube is thus prevented.

As regards the objections to skin grafting, it has been pointed out that it is impossible to get the cavity aseptic, but, in practice, it has been found that this makes no difference, and that, in 99 out of every 100 cases, the graft takes perfectly well, and that, even in the exceptional cases when the grafting is not a complete success, islets of cells are left behind from which the skin quickly grows over the cavity. At the same time, I should like to point out that, in performing the radical mastoid operation, it is essential to open up all depressions in the bone thoroughly, so as to make sure that septic cavities are not left behind the graft ; it is also necessary that the graft should be extremely thin.

With regard to the hearing, Ballance, in his original paper,

been advocated by Dr. Stoddart Barr.

Cutting the skin grafts has, I believe, caused some surgeons a considerable amount of trouble, and probably one reason why, at times, good results have not been obtained, is that these have been cut much too thick.

The method I employ is as follows :—

The patient's thigh is placed in the abducted and everted position, with a small sandbag under the lower end so as to get a flat surface ; the skin is then cleaned with soap and water, and afterwards well rubbed with a sponge soaked in ether. I take up my position by the side of the patient, being on the right side if the right thigh is used, and on his left for the left thigh. My assistant, who stands on the opposite side, then places the ulnar surface of his hand about three inches above the knee, and draws the skin downwards towards the knee as much as possible. With my left hand, I make counter traction towards the hip, so as to get the skin fully stretched, and then, with a hollow-ground razor, which is about half as large again as the ordinary shaving razor, I cut a thin graft about 3 ins. long and 2 ins. wide, always cutting towards the knee.

Various methods have been suggested with the idea of making this part of the operation easier. For example, Waggett recommended painting the skin with "newskin," Wyatt Wingrave, a solution of celloidin in acetone (10 per cent.), and Deanesly advised applying sticking-plaster to the thigh before cutting the graft, and the suggestion has been made that a piece of board should be used instead of the assistant's hand to keep the skin on the stretch, so as to get a more level surface, but I think none of these aids is really necessary after a very little practice.

With regard to the advantages and disadvantages of skin grafting, the advantages, in my opinion, are :—

- (1) The cavity heals much more quickly than by other methods ;
- (2) Contraction and stenosis of the cavity are prevented, and, at the same time, there is no possibility of granulations extending across various parts of the cavity, and so shutting off cavities which remain unhealed and cause persistent discharge ;

margin around the stapes, after which the opening of the Eustachian tube is curetted with a small, sharp spoon. In order to disinfect the cavity and check the bleeding, I next pour in hydrogen peroxide (20 vols.), which is left in for two or three minutes, and then syringed out with normal saline at 105° F. This is done three times. The cavity is immediately plugged with gauze, the plug being left in while the graft is cut, and only removed when everything is quite ready for applying the graft. This is carried to the ear on a section lifter, and got into position by means of the suction apparatus recommended by Mr. Ballance. It is kept in place by the immediate insertion of a long strip of ribbon gauze, half an inch in width, on which has been dusted some aristol powder to prevent the discharge from becoming offensive. No protective of any sort is used. The end of the gauze is passed through the meatus, and the free end of the graft which is lining the posterior part of the cavity is folded over the plug and also brought out through the meatus, so as to cover its cut edge. After ligaturing the vessels which have been caught with artery forceps during the operation, the skin opening is sutured so as to bring the ear back into its normal position.

The plug is left untouched until the fourth day after the operation, when it is withdrawn and the cavity syringed out with a weak solution of hydrogen peroxide, a small piece of ribbon gauze being again lightly inserted to soak up the discharge. The same treatment is continued daily for about one week, when all plugging is stopped and plain hydrogen peroxide (10 vols.) is dropped into the cavity twice daily. The patient is seen at intervals of about seven days, so that any small areas, which are granulating too freely, can be cauterized with silver nitrate or scraped with a sharp spoon.

The superficial part of the graft gradually separates, and usually comes away when the ear is syringed, but it may be necessary to remove it with forceps. When the cavity is nearly healed, I often prescribe rectified spirit or equal parts of hydrogen peroxide (20 vols.) and rectified spirit, so as to harden up the skin surface.

In my opinion, primary skin grafting is to be preferred to blood clot dressing for, in the latter method, in addition to the risk of the clot becoming infected and breaking down,

THE PRACTITIONER.

stated that he found the result much the same as after the older method of dry gauze tamponing, and, in a later note, added that the result was better than in the older method, attributing this to the very thin layer of tissue which formed over the *fenestra ovalis*. Ballance has stated that 75 per cent. of a number of private cases tested showed remarkably good hearing as the result of the operation. Grafting certainly has one small disadvantage, and that is that the cavity is very liable to become filled with a collection of cerumen and epithelium, which, if left, may cause ulceration of the skin surface; but the collection is easily removed and, if done regularly once or twice a year, no harm results.

We may now consider the question of primary skin grafting, *i.e.*, the application of a graft at the time of the original mastoid operation. I first tried this method in March, 1908, and, since then, have used it regularly in uncomplicated cases of chronic mastoid disease, but I do not use it in cases of acute mastoid disease in which it is necessary to perform a radical mastoid operation, preferring in these cases to do the skin grafting at a later date.

The advantages of the primary skin grafting are, in my opinion:—

- (1) Seven to ten days are saved in the convalescence of the patient;
- (2) It does away with the necessity of a second anæsthetic, which many patients so much dread, and I think that taking two anæsthetics so close together certainly affects the patient's general health, especially in the case of those who are very nervous.

The method I employ is as follows:—

I first perform the ordinary radical mastoid operation, taking care to remove as far as possible every trace of disease, and exposing the dura of the middle fossa and the lateral sinus, if I am not quite satisfied with the appearance of the bone lying in contact with these. After cutting a meatal flap, I cut down the posterior bony meatal wall as much as possible, and then scrape out the tympanum, removing the whole of the mucous membrane, except a very small

case which took four months) the delay was partly caused by the patient stopping away for two months soon after leaving hospital.

I should like to mention that in these 50 cases, the dura of the middle fossa was exposed in 25, the lateral sinus in 2, and both the dura of the middle fossa and the lateral sinus in 15; thus, in 42 out of the 50 cases, there was exposure of some part of the dura. In no case was it necessary to remove the graft on account of suppuration.

I have also looked into the important question of hearing, though, unfortunately, only a watch was employed. Of the 43 cases which I was able to follow until they were completely healed, I found that 2 had internal ear deafness before operation, and, in 2 more, the original hearing was not noted, so that I can only deal with 39. Of these the hearing improved in 29 (74·3 per cent.), deteriorated in 8 (20·5 per cent.) and remained unaltered in 2 (5·2 per cent.).

The results given by Grunert, after the tamponning method were, improved 55 per cent., unaltered 39 per cent., diminished 6 per cent., and by Stacke, who employed the same method, improved 36 per cent., unaltered 57 per cent., diminished 7 per cent.

I must, lastly, say a few words about the cases of chronic mastoid disease in which complications are present. If there is a fistula in the bony wall of the semi-circular canal, without damage to the membranous canal, I apply a primary graft, and in the series of cases I have just mentioned, there were two cases of bony fistula; one was perfectly healed in six weeks, and the other returned to the country at the end of three weeks, when the cavity was healed except for the posterior cartilaginous meatus, which was still granulating. Both cases were relieved from the giddiness from which they suffered before operation.

In cases of suppuration of the internal ear, I do not apply a graft, for the object of the operation is to obtain free drainage, and I think that the application of a graft is very liable to defeat this object.

the granulations formed in some individuals are liable to become too exuberant, and, instead of being transformed into a glistening membrane, have a tendency to fill the whole cavity with fibrous tissue, causing obstruction of the round and oval windows. In any case, it is better to have the cavity lined with healthy skin rather than with cicatricial tissue.

With regard to scarlet-red and similar substances, the chief objections are that constant attention is required, and that pockets are liable to form owing to granulations from different parts of the cavity fusing together. This method may, however, be useful for the healing of granulating areas when the graft has not taken well.

When I started to use primary grafting in 1908, I kept notes of my first 50 cases, and I have referred to these to see how long each case took to heal, *i.e.*, for the cavity to become completely covered with skin and absolutely dry. In these cases, the plug put in at the time of the operation was left in for seven days, instead of four days as I do now. Although I cannot give exact figures for a series of my later cases, I feel certain that my results at the present time are considerably better than they were in 1908, for I pay more attention to the posterior meatal wall and remove as far as possible any exposed portion of cartilage, because I found that this was responsible for the delay in healing in the majority of cases.

Of these 50 cases, 7 were lost sight of after leaving hospital, for 5 returned to the country and were not seen again, and 2 failed to attend for treatment. I therefore can only deal with the remaining 43. Of these, 1 healed in 19 days, 1 in 21 days, 6 in one month, 1 in 5 weeks, 7 in 6 weeks, 7 in 7 weeks, 5 in 2 months, 6 in $2\frac{1}{2}$ months, 1 in 3 months, 1 in $3\frac{1}{2}$ months, 3 in 4 months, 1 in $4\frac{1}{2}$ months, 2 in 5 months, and 1 in 9 months, so that you will observe that 34 out of the 43 cases were healed in $2\frac{1}{2}$ months or under. Of the other 9 cases, caries of the internal wall of the tympanum caused the delay in 4, *viz.*, 1 of $3\frac{1}{2}$ months, 1 of 4 months, 1 of $4\frac{1}{2}$ months, and 1 of 9 months; caries of the floor of the aditus in 1 of 4 months, and the posterior cartilaginous meatus in the other 4 cases, *viz.*, 1 of 3 months, 1 of 4 months, and 2 of 5 months, and in one of these (the

case which took four months) the delay was partly caused by the patient stopping away for two months soon after leaving hospital.

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must do nothing—for instance, an extensive incision and proper and efficient drainage may save a limb, a projectile skilfully removed at the right time may save a life.

At the present moment, a great controversy has arisen as to the proper treatment of infected wounds—between those who remain faithful from previous experience to the older antiseptic methods, and those who follow what may be called the physiological school, and rely almost entirely on efficient drainage, moist heat, and certain lymphagogue solutions, thus bringing into play the germicidal properties of fresh lymph and the phagocytes it contains. Tuffier¹ well says: "This question, chief in importance of the treatment of infected wounds, necessitates a knowledge of the pathologic physiology of wounds." So far no ideal antiseptic, that is, one that is actively bactericidal and not, at the same time, cytolytic, has been discovered, although many surgeons claim the efficiency of many and various substances. But Tuffier again remarks, that in looking into the matter more closely, he has always found that their successful treatment was due to the extremely attentive care which these surgeons gave to the wounded, rather than to the product used. Thanks to the brilliant work of Sir Almroth Wright, Alexis Carrel, and their co-workers, much new light has been thrown on a problem of tremendous difficulty, which cannot fail to be of inestimable value to mankind. What is more, further development of this work must arise, since it proves again the absolute advantage and necessity of the co-operation between the scientific laboratory worker and the surgeon.

This great war has already provided fresh fields for the skilled operator, of which we get gleanings from the medical journals, but the great total has yet to be written and summarized. The man of dexterity and mechanical skill will have abundant opportunities of demonstrating his talent and doing good work—either in the casualty clearing stations near the fighting line, where lives and limbs are to be saved, or at the base, where the most important reparative operations are performed.

The surgery of to-day is no simple handicraft, but rather a science of great and increasing complexity founded on present-day knowledge of human anatomy, physiology, and pathology. Without an intimate knowledge of these sciences,

SURGICAL EFFICIENCY—A PLEA FOR BETTER FACILITIES AND TRAINING.

BY JOHN H. WATSON, M.B., B.S., F.R.C.S.

Surgeon, Victoria Hospital, Burnley.

THE advent of the great War has brought extra surgical work to a great many practitioners. Some are serving in military hospitals at home or abroad, others are left behind in many provincial towns and have to attend to general surgical cases in greater numbers than ever before; consequently, there are numerous good openings for able men, who are inclined to practise surgery, to develop their particular aptitude for such work.

The responsibilities attending the practice of surgery are not to be undertaken lightly, for, as we all know, minor surgical troubles may end in disaster. We must, therefore, make ourselves efficient, as far as we possibly can, with the provision of doing our bit, not according to what are our own peculiar lights on surgery, but according to what is the best for the ultimate welfare of the patient—be he soldier or civilian. This efficiency, I maintain, is only to be secured by working on the approved scientific principles which form the basis of modern surgery.

War surgery opens up a new field for most of us. We are told that military surgery is not the same as civil surgery, and particular emphasis in the former is laid upon conservative surgery, but these differences depend, for the most part, upon environment. Rothe says the grave difficulties of war surgery are encountered in emergency stations, which are not provided with light, or even running water, or there may be only imperfect means of sterilizing the available water supply. Again, much needed surgical supplies cannot be got, trained assistance is often wanting, and the proper time and attention necessary for each individual case cannot be given as in civil practice. Despite these facts, war surgery is peace surgery under changed conditions. To say that war surgery is conservative does not mean that the surgeon

must do nothing—for instance, an extensive incision and proper and efficient drainage may save a limb, a projectile skilfully removed at the right time may save a life.

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who thus finds an unfailing enthusiasm to continue his studies, and who ultimately becomes the most efficient surgeon and the man of greatest learning.

On the other hand, there are great numbers of men, often inexperienced in diagnosis, unskilled in technique, ignorant of anatomy, careless and unsafe, carried away by the glamour of surgery into fields which they are totally unfit to enter, whose results would be appalling but for their good fortune, aided by the healing power of their patients; for it is truly astonishing to observe from what extraordinary injuries and manipulations a patient may recover.

It must not be taken for granted that even the best surgeons are infallible, but they are at least honest in their desire to find the truth, to admit their errors, to apply the lessons of their failures, and, if serviceable, to publish them for those who follow. How necessary, then, must it be for the ordinary surgeon to be extremely careful even in the well-trodden fields of legitimate surgery, and how much more so in any attempt to adopt questionable procedures, unless he has ascertained as far as possible the dangers. Progress is said to follow on failures, or, in other words, trying again until you succeed, but this implies considerable persistence and ability to seek out the causes. In some cases they may be conspicuous, in others obscure or undetectable, but, in far too many, they are due to faulty technique or want of careful study of the contra-indications of an operation.

We have passed the time when there is any need to take risks in a straightforward operation, but it is still impossible to say that every man practising surgery to-day is worthy of the name of surgeon. Ill-considered and badly conducted operations are still performed too frequently, and probably more fruitless surgery is undertaken to-day because the modern technique renders such operations comparatively safe. I repeat there is no royal road to the art of a surgeon. The heaven-sent surgeon has never been born, and never will be. Practice and experience are still absolutely essential in the making of a surgeon, but he must cultivate as well an equable temperament, clear thinking, and a sound judgement, so that he may act with all due swiftness and precision. With these attributes, he may be able to ensure victory when defeat seems imminent, avoid certain disaster,

no man can hope to practise the art of surgery. There is no royal road to become a surgeon. The long years of apprenticeship, which our predecessors underwent, are as necessary in these days as they were in theirs.

It is a long step from the mere operator to the real surgeon, for the days of the so-called pure operating surgeon are gone. We do not want a man now who is only capable of performing a series of set operations on the lines of an operative surgery class. We look to one who can array the various factors that present themselves in any particular case, give a sound surgical judgement, and act accordingly. If he operates, we expect to see every step performed with due regard to the anatomical structures involved, with gentleness, care, and all due *celerity of manipulation*, maintaining at the same time a strict and well-considered surgical technique, be it antiseptic or aseptic. Added to this, he must have the ability to recognize and solve, to the best interests of the patient, the peculiar problem in living pathology he presents, so that a complete operation is performed. There is no need to visit many clinics or hospitals to find out how varied are the methods and manipulations of surgeons. Some we see are rapid and dexterous, others cautious and slow; some daring and cool, others over-anxious and nervous. Another surgeon impresses with his teaching powers, yet another with his careful and scientific technique.

Again, one will see one man employing a most elaborate technique, and another using few instruments and the simplest methods. We may be impressed on observing the excellence of the combined work of a surgeon and his assistants in one hospital, and at another by the accuracy of clinical and pathological investigation. I would like to lay great emphasis on the inspiring effect of systematic visiting of various hospitals and clinics—not necessarily in the big towns of England only, but also to special hospitals at home and abroad. It gives one not only a fresh stimulus, but provides matter for reflection in reviewing and overhauling one's own methods and resources. By such means, we stand to learn much, and get to know the men who are the real leaders in surgery, and who set the pace. It should be the ambition of every progressive surgeon to follow and emulate them, for it is the man who has been inspired to work,

of the young surgeon, comes the critical moment for deciding his future. If his hospital is also a training school, he may obtain a surgical registrarship or an appointment in the school as demonstrator of anatomy, physiology, or pathology. Here he will have time for surgical reading, facilities for research, and be able to keep in touch with hospital work. If he aims for appointment to the staff, he must obtain the higher surgical qualifications during this period.

A more difficult course is that presented to the man who, from force of circumstances, takes up his abode in one or other of our provincial towns. To obtain a surgical practice, it is necessary for him to obtain a surgical appointment at the local hospital, and it is therefore to his interest to cultivate the friendship of the staff. This is to be brought about by attending the out-patients, the wards, and the operations, and by endeavouring to make himself useful. There may be much of which he does not approve, but nothing is to be gained by foolish and carping criticism of members of the staff, and his chances of appointment are considerably reduced by such ill-advised tactics. I have known more than one man block his career by unmannerly conduct of this type. If he proves his worth, he may be fortunate enough to obtain an assistantship with a surgeon of known ability whilst waiting for a junior appointment.

We want our younger men to be better trained and better equipped, in order that they may follow on with their improved facilities, and become more able than ourselves. In order to do this, there is need to set the house in order in England, if we are to play any larger part in the advancement of surgery. We cannot live on the past achievements of Hunter, Astley Cooper, Syme, Simpson, Lister,—to mention only a few.

There is much for us to learn from the surgical clinics of France, Germany, and America. Here, in England, any man may practise surgery; this, I maintain, is a gigantic mistake, and a menace to the public which often brings discredit to our art. Of late, much has been said about standardizing the surgeon. Surely, it is much better to develop the surgeon on sound lines than to allow the untrained operator to bring about his own undoing, through one or more surgical disasters. Certainly, it is more humane, more just to the

and thereby be the means of bringing about the ultimate recovery of otherwise doomed sufferers. Mark, therefore, at once, that it is a long step from the mere operator to the real surgeon, who considers his duty, above all, to be thorough in every surgical undertaking.

As surgery has grown by leaps and bounds, our knowledge of detail has been multiplied many times. The successful surgeon nowadays is the thoroughly trained and observant man—the man who knows his anatomy, physiology, and pathology, and can apply it; the man who studies his patient in every way before he operates, not omitting to call to his aid expert advice whenever necessary, for often no final diagnosis can be made until all possible findings have been subjected to a rigid and logical analysis. He must, therefore, be able to make a sound diagnosis and perform a complete operation. Such a man must read and keep up with current surgical literature, and, for his honour and advantage, will endeavour to keep in touch with others doing good work by frequent visits to various surgical clinics at home and abroad.

This system of visiting, which appears to be rather neglected at home, is greatly in vogue in America and on the Continent, and is of inestimable value to the progressive surgeon by bringing him in touch with fresh methods, variations in technique, and modifications in equipment from which he stands to gain much and lose little, and he will return to his work with an added enthusiasm and with fresh ideas. On these lines is the modern surgeon made, and thus he honestly acquires confidence in himself, and becomes justly reliant on his skill and preparedness for any emergency. I would sound a note of caution for the younger men who are primarily inclined to practise surgery, which is that they must be sure that their foundations are sound.

My own views of thorough training are based on the belief that, to become a useful surgeon, a man ought to spend, after qualifying, at least twelve to eighteen months as a resident in a hospital or hospitals having well trained and organized visiting staffs. Under such conditions, he will get invaluable experience in general medicine and surgery, including their sub-divisions and, what is most important, practice in the giving of anæsthetics. After this hospital training, which forms the nucleus for further development

of the young surgeon, comes the critical moment for deciding his future. If his hospital is also a training school, he may obtain a surgical registrarship or an appointment in the school as demonstrator of anatomy, physiology, or pathology. Here he will have time for surgical reading, facilities for research, and be able to keep in touch with hospital work. If he aims for appointment to the staff, he must obtain the higher surgical qualifications during this period.

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public, and to the highest aims of surgery, that men should be thoroughly fitted by special training and study to practise major surgery, whereas those unwilling to follow such a course should be denied this right. To the keen man, settling in the larger towns with good hospital experience, opportunities frequently arise, and although the waiting may be long, a fixed determination and ability not only merits but commands success. I believe the time is coming when steps will be taken to prevent a great deal of promiscuous and harmful surgery. This can, to my mind, only be done by due insistence on a long and thorough training of the young surgeon—not by submitting him to a series of examinations of questionable value and uncertain standard, but by drawing up a certain post-graduate course of application to extend over a period of years on the lines of the American College of Surgeons. This body now insists that to obtain their fellowship, the applicant shall give proof of the efficiency of the work that he does with his head and his hands. After duly qualifying he must :—

- (1) Serve at least one year as a house-officer—preferably in a hospital with varied service.
- (2) Serve at least three years as a second assistant or one year as a first assistant to a surgeon of recognized ability, and with an adequate hospital service, and must supplement his individual report of operations by a further report of at least 100 cases in which he has thus acted as assistant.
- (3) Show evidence that he has visited other surgical clinics than those to which he has been officially appointed.
- (4) Give a list of his publications, indicating those which he has in the course of preparation.
- (5) Show some work done for the advancement of the general cause of surgery.
- (6) Finally, give a report of his own work, narrating 50 consecutive cases of major operations done by himself, in detail.

This, to my mind, is a far better course of training than any we adopt in this country, and might be copied here with advantage to all concerned.

Finally, I cannot refrain from quoting the fellowship pledge of this same body, which embodies the best ideals and principles of our calling:—"In particular, I pledge myself to pursue the practice of surgery with thorough self restraint, and to place the welfare of my patients above all else, to advance constantly in knowledge by the study of surgical literature, the instruction of eminent teachers, interchange of opinion amongst my associates, and attendance on the important societies and clinics, to regard scrupulously the interest of my professional brothers, and seek their counsel when in doubt of my own judgement, to render willing help to my colleagues, and to give freely of my services to the needy. Moreover, I pledge myself, so far as I am able, to avoid the sins of selfishness, to shun unwarranted publicity, dishonest money-seeking and commercialism as disgraceful to our profession; to refuse utterly all secret money dealings with consultants and practitioners, to teach the patient his financial duty to the physician, and to urge the practitioner to obtain his reward from the patient openly, to make my fees commensurate with the service rendered and with the patients' rights, and to avoid discrediting my associates by taking unwarranted compensation. Finally, I pledge myself to co-operate in advancing and extending, by every lawful means in my power, the influence of the American College of Surgeons."

Throughout our larger and smaller provincial towns, hundreds of hospitals have been built, which mark, undoubtedly, a tremendous advance in the cause of human welfare, and in which is done an enormous amount of surgery, good, bad, and indifferent. The nature of the work depends upon the calibre of the surgical staff, this staff, in most instances, being elected by a lay committee, which cannot comprehend entirely the respective merits of all their candidates; consequently, any man who holds a degree may be appointed. He may have had very little actual surgical experience, yet he is permitted to perform operations, despite his lack of training. The fact that he holds some surgical qualification is considered sufficient evidence of skill and training, but I ask, is this enough? Are these men fit to undertake complicated abdominal operations, or, for that matter, any major operations? The nature of such untrained and unskilled work, Mixer² tritely remarks, "can

be imagined, but it is seldom described."

Unfortunately we are at a great disadvantage compared with American and continental surgeons, who possess better facilities for doing research work on animals. They have more schools of practical surgery for their graduates, and the larger clinics provide assistantships, where men can live and work long enough to acquire some of the art and skill of the master surgeon. Even in the smaller hospitals, the chief of the surgical clinic is generally a young surgeon of experience and skill, who has worked with a master, and is capable of training others and imbuing them with his own ideas and enthusiasm. There must be drastic changes, if English operative surgery is to command a place in the foremost rank. The standard needs raising. Our surgeons must have better opportunities for research. There is urgent need for graduate instruction in the larger provincial towns, and there should be better chances for our younger men to be given posts under reliable and competent surgeons.

We are sadly behind in what the Americans call team work. If anything has been taught by this war, it is the inestimable value of the combined work of the practical surgeon, the laboratory expert, and the radiographer. Such combinations ought to be more frequently available in civil practice, nor should there be any hesitation in making the combination larger by including the physician, ophthalmologist, or other experts, as occasion arises. Such combinations cannot be other than helpful in the diagnosis, and in outlining the treatment; moreover, they relieve the surgeon of much responsibility which, in the past, he was frequently obliged to undertake, not to mention the ultimate gain of the patient.

There is ample scope for greater observation in diagnosis and better practice in the after-treatment of surgical cases. Technical skill and dexterity, although important, are not everything; in our ideal surgeon we must have a man of sound surgical judgement as well, and, therefore, it should be the aim of every surgeon who is worthy of the name, to be constantly endeavouring to improve himself in every side of his art.

REFERENCES.

¹ Tuffier: *Surgery, Gynaecology and Obstetrics*, September, 1915.

² Mixter: *The Journal American Med. Assoc.*, November 6, 1915.

RECENT WORK IN RADIUM, RADIOLOGY AND ELECTRO-THERAPEUTICS.

BY N. S. FINZI, M.B., CAPTAIN R.A.M.C. (T.).

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RADIUM.

TRACY¹ deals with the internal administration of solutions of radium salts and of radium emanation. The strength of the solution of the former is from 1 to 3 micrograms to 32 c.c. of water. The solution of the latter is made by suspending rods of insoluble radium salt in a cylinder of water. The physiological effects of taking radio-active water by the mouth are increased metabolic changes, increase in the number of red blood corpuscles, decrease in blood pressure (injection of radium solution intravenously produces a much more marked and permanent effect on the blood pressure); the viscosity of the blood is reduced, as well as the coagulation period, the action of ferments is accelerated. In a number of cases of rheumatism and gout (cases collected from various sources), 80 per cent. were benefited or cured. Arterio-sclerosis has been treated with a considerable degree of success. Neuralgia, sciatica, insomnia, nephritis, and diabetes have given good results.

Bissell's² results and quoted cases confirm the above observations as to the physiological effects.

Stevenson³ puts forward a claim for the method of treating malignant growths by the insertion of radium needles. It may be pointed out that he makes a bad mistake in physics, when he takes the absorptive power of 3 millimetres of lead as equivalent to 3 centimetres of human tissue; it is many times as much. In discussing the use of radium salts in tubes buried in the tissues, he draws the deduction that:—"All filtering in radio-therapy is simply and solely a method of obtaining uniformity of radiation." Now this is wrong; the chief object of filtering is to obtain a different type of ray, or, rather, is so to alter the proportions of the unfiltered rays that the preponderance of one or more types

be imagined, but it is seldom described."

Unfortunately we are at a great disadvantage compared with American and continental surgeons, who possess better facilities for doing research work on animals. They have more schools of practical surgery for their graduates, and the larger clinics provide assistantships, where men can live and work long enough to acquire some of the art and skill of the master surgeon. Even in the smaller hospitals, the chief of the surgical clinic is generally a young surgeon of experience and skill, who has worked with a master, and is capable of training others and imbuing them with his own ideas and enthusiasm. There must be drastic changes, if English operative surgery is to command a place in the foremost rank. The standard needs raising. Our surgeons must have better opportunities for research. There is urgent need for graduate instruction in the larger provincial towns, and there should be better chances for our younger men to be given posts under reliable and competent surgeons.

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overlapping radiation in the same way as Dr. Stevenson, but, eliminating the harmful effects of the soft rays, and using fewer sources of radiation. A modification of the method may possibly come into more general use.

The report of the Radium Institute⁴ is, as usual, a valuable document, and should be in the possession of those interested in the subject. We would suggest that it would be an improvement, to tabulate not only the cases of any one year, but those covering the whole period of the Institute's activity, as then the results would not be so overweighted with unfinished cases. The cases "examined but not treated" should also not be included in the "total" column. For instance, 55 per cent. of the total rodent ulcer cases are "apparently cured," while 29 per cent. are "improved." Now some of the former will recur, while some of the latter will, no doubt later, be placed in the former category, and the proportion of corrected results will improve each year.

Little or nothing is said in the cases described of prophylactic treatment after macroscopical evidence of the growth has disappeared, and we venture to think that, in most cases, the good results will be transient unless vigorous prophylactic irradiation is adopted. If radium rays should be used as a prophylactic after surgical measures, and there is everything to be said for this, why not as a prophylactic after radium treatment. There is one interesting point in the case of carcinoma of the thyroid described. Apparently the thyroid gland only was treated, as far as one can judge from the description, but, nevertheless, masses of growth in the thorax diminished considerably. Was this from stray rays which passed through the thorax, or was it from some cytolytic action? Among the most successful cases are sarcomata, carcinoma of the uterus, and certain other carcinomata. The results in rodent ulcer show a distinct improvement on last year. The report is, as usual, moderate in its claims, and attempts to present the treatment fairly, neither over- nor under-stating the case.

Bryant⁵ records a case of deafness resulting from chronic middle ear suppuration, which was very greatly improved by a treatment with the rays from mesothorium. 5 mg. of mesothorium bromide was used (this probably refers to its radium bromide equivalent), and 262 milligram-minutes

masks the action of the others. That, at the same time, we tend to get uniformity of radiation is a great advantage, but, by no means, the sole result. It is here that clinical medicine disagrees with the theories of physics; even if, as Professor Joly claims, the hard rays do their work by means of soft radiations excited by them in the cells, this is no argument against their use. At any rate, soft radiations from outside do not produce the same effect.

As a matter of fact, Stevenson's method of obtaining uniform radiation is undoubtedly a useful one, and his results are due, at any rate, in part, to the filtration, slight though it is, exerted by the steel needles; they would probably be better still if he used platino-iridium needles. He suggests that incising a tumour with a knife in order to introduce a radium tube is likely to cause dissemination, while puncturing it with serum needles is free from this danger. We cannot see why one method should be more dangerous than the other. The chief objection to every method of using emanation for local treatment is not mentioned, namely, that it is wasteful. If you have 100 mg. of metallic radium (about 187 mg. of radium bromide), you can only draw off from it and collect about 12-14 millicuries of emanation every day with the most perfect apparatus (16.5 millicuries are formed, but there are always losses in manipulation). On the other hand, if you have the radium salt, you can use your 100 millicuries every day. It is true that with the first method, after a fortnight or so, you will have a number of needles, each containing a different amount of emanation, but, as some will now have less than 1 millicurie, they will probably be discarded; added to which waste there is the waste in extraction and filling tubes. It would, however, be quite possible to apply Dr. Stevenson's method with radium salts by sealing them into platinum needles in such quantities as to give the 3 or 4 millicuries of emanation that he favours. There is even with this method a difficulty as to uniformity of radiation; we may consider that there is a spherical area of activity around each needle, and unless these overlap most effectively, some of the cancer cells will be spared, and remain to produce a recurrence, while, if they do overlap effectively, there will probably be areas of over-exposure. Finally, the users of tubes generally try to use them in such a way as to produce

avoid leaving cells which are insufficiently irradiated, and, therefore, capable of renewed proliferation.

The histological changes during the retrogression are shown by four micro-photographs. Ten days after the commencement of the application, the growth shows hypertrophy of the majority of the cellular elements, enlargement and irregularity of the nuclei, with a few enormously enlarged nuclei, and the protoplasm tends to acidophilia. Twenty-nine days after the commencement, disappearance of the neoplastic cells is observed, though a few hypertrophied cells are seen in a state of advanced necrosis; cicatrization is occurring, and there are a large number of young fibroblasts in a connective tissue reticulum, rich in cellular elements. Three months after the start, there is merely a fairly dense connective tissue, rich in cellular elements.

RADIOTHERAPY.

Dachtler⁸ has an important paper on the post-operative prophylactic treatment of carcinoma of the breast. Before commencing the investigation, he visited many institutions to study the technique employed and the results obtained. He found that "wherever unfavourable opinions of the treatment were given, almost invariably on investigation, faulty methods of technique were discovered." Dachtler's cases, which were treated more than five years ago, number 29; of these, 16 did not show macroscopic involvement of the axillary glands, 13 of them were still alive, after over 5-8 years, the other three died of intercurrent disease, in two of these no sign of recurrence was found, while the third died of endothelioma of the brain and showed no recurrence of the original carcinoma. Of the other 13 cases with marked axillary involvement, 9 died within six months after the operation, and all but one of these were free from any local recurrence. The other four lived varying times up to five years, and got no local recurrence. A striking fact is, that some of the patients got recurrence on the opposite side of the chest, while the treated side remained free. Treatment was given every day for the first fortnight, with an anode distance of 12 inches, and through a leather filter. After a fortnight's interval daily treatments were again given, until 30 or 40 had been given, 35 being the average number. If too severe a reaction

were applied to one ear, 420 to the other. No filtration of the rays is mentioned.

Aikins⁶ in a lecture on his experiences with radium, corrects the erroneous impression that malignant disease is the only condition for which this substance is useful. He particularly mentions its great efficiency in papillomata, while in angiomas, cheloid, eczema, and psoriasis it is also very successful. It is recognized as the best means of attacking rodent ulcer, and it is satisfactory to note that the progress of this disease is even arrested when it is attacking bone and cartilage, a fact not so generally known. He has also had good results in goitre, both simple and exophthalmic; only in one case out of ten of the latter variety did no improvement occur. Epithelioma of the skin, when confined to the skin, responds as readily as rodent ulcer. With epithelioma of the lip, too, he has been very successful. He has treated 20 cases of sarcoma, six of which he regards as cures. In one of these, he was able to obtain a section during the course of the treatment; this is of great interest in showing metamorphosis of the type of growth from a small round-celled sarcoma into mixed-celled, chiefly of the large spindle-celled type. There also occurred deep pigmentation, due to the deposit of haemosiderine, and great enlargement of the nuclei, with occasional giant nuclei. The necessity for the use of large doses is mentioned, but no reference is made to the technique, dosage, or quantity employed.

Degrais and Bellot⁷ hold that in malignant disease of the uterus radium therapy can, with advantage, supplement surgical technique, and is a valuable substitute for it in inoperable cases and recurrences. While they recommend surgery, followed by prophylactic irradiation in cases that are operable, they have had such a case which refused operation, and in whom the disease was removed by radium, and did not recur up to the time this paper was written, more than four years later. They are able to affirm that there has not been a single inoperable case in which the patient has not derived real benefit from the radium treatment. They advise curettage before the radium application. They advise continuance of the irradiation at progressively longer intervals after the growth has disappeared, and point out the necessity to irradiate in as complete a manner as possible in order to

avoid leaving cells which are insufficiently irradiated, and, therefore, capable of renewed proliferation.

The histological changes during the retrogression are shown by four micro-photographs. Ten days after the commencement of the application, the growth shows hypertrophy of the majority of the cellular elements, enlargement and irregularity of the nuclei, with a few enormously enlarged nuclei, and the protoplasm tends to acidophilia. Twenty-nine days after the commencement, disappearance of the neoplastic cells is observed, though a few hypertrophied cells are seen in a state of advanced necrosis; cicatrization is occurring, and there are a large number of young fibroblasts in a connective tissue reticulum, rich in cellular elements. Three months after the start, there is merely a fairly dense connective tissue, rich in cellular elements.

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occurred, treatment was discontinued for one or two weeks. A deep tanning of the skin was produced. He does not recommend any subsequent treatment.

Dr. Levin⁹ presents a most fair-minded review of the relation between the surgical treatment and the radio-therapy of cancer. After examining the statistics, he comes to the conclusion that rather less than 30 per cent. of cancer patients can hope to be cured by surgery alone. If radiotherapy should change the figure only to 35 per cent., the method of treatment is more than justified. Radiotherapy acts in virtue of its selective action, the injury caused by the rays to the cells of the growth being greater than that caused to healthy tissues. He advocates a combination of surgical treatment with radiotherapy. With regard to technique, he employs 50 mg. of radium bromide screened by 0.5 mm. of silver, and generally 0.75 mm. of brass in addition, paper and india-rubber being also used to cut off the secondary rays. For extensive growths, this amount is applied for 12 hours every other night until 100 hours have been given, and then, if necessary, another shorter course after four weeks. X-rays are used in a method like that of Krönig and Gauss, except that fewer and larger ports of entry are employed. Three millimetres of aluminium are used as a filter. At the time of writing, his experiments with the Coolidge tube were not far enough advanced for publication.

Arcelin¹⁰ has an important paper on the difficult and intangible subject of late X-ray effects, of which he has collected eight cases, in two of which, however, the only effect after the conclusion of all X-ray treatment seems to have been the development of telangiectases. He does not distinguish between cases treated by filtered and unfiltered rays, but a study of his cases bears out Spéder's contention that late reactions only occur when filtered rays have been used, *unless the unfiltered dose has been sufficient to produce a burn*. Arcelin points out that these late effects are more likely to develop when large areas have been treated. He shows that when a patient has been treated with X-rays, and received a large dose, a subsequent treatment, after an interval of a year or more, with similar doses, may sometimes provoke a dermatitis, whereas none had previously developed. He follows Nogier and Regaud in the belief that the use of thicker

filters (3 to 4 mm. of aluminium) will prevent the occurrence of these reactions.

The author of this review, however, has a paper (*Journal of the Röntgen Society*, Vol. XI., No. 44) on the same subject, in which he describes a case of late X-ray reaction in a patient in whom the rays had, throughout the treatment, been filtered through 3.6 mm. of aluminium.

RADIOGRAPHY.

During the year, a great deal of attention has been devoted to the question of localization of foreign bodies, and many so-called new methods introduced to make the procedure more simple and rapid. Most of these, however, are only useful for the localization of the depth from a given point on the surface; for the localization of the position of a foreign body in the three dimensions of space, the old methods are still employed. All the new methods are modifications of older ones, and various forms of new apparatus have been introduced to make the calculation more rapid and more simple. The methods all fall under three heads:

- (1) Triangulation.
- (2) Right-angled planes.
- (3) Parallax.

Many radiographers seem to use one to the exclusion of all the others, but each method has its uses at times. A number of these methods are described in the *Journal of the Röntgen Society* for January and April, 1915.

Cotton¹¹ advises the examination of an X-ray negative from the film side with one eye, and at a distance the same as that of the focus-point of the X-ray tube from the plate. By this method, one obtains the advantage of perspective. His claim that this method supplants stereoscopy will hardly be generally accepted. The examination of the negative through the glass side, however, has certain advantages, though Dr. Cotton is theoretically correct, and it is unlikely to be discontinued. The subtle suggestion, that it is wrong because it originated in Germany (did it?), may well be countered by the remark that the discovery of X-rays was made in Germany. An instrument, "the radiographic episcopes," is described to view a patient and his radiogram

occurred, treatment was discontinued for one or two weeks. A deep tanning of the skin was produced. He does not recommend any subsequent treatment.

Dr. Levin⁹ presents a most fair-minded review of the relation between the surgical treatment and the radio-therapy of cancer. After examining the statistics, he comes to the conclusion that rather less than 30 per cent. of cancer patients can hope to be cured by surgery alone. If radiotherapy should change the figure only to 35 per cent., the method of treatment is more than justified. Radiotherapy acts in virtue of its selective action, the injury caused by the rays to the cells of the growth being greater than that caused to healthy tissues. He advocates a combination of surgical treatment with radiotherapy. With regard to technique, he employs 50 mg. of radium bromide screened by 0.5 mm. of silver, and generally 0.75 mm. of brass in addition, paper and india-rubber being also used to cut off the secondary rays. For extensive growths, this amount is applied for 12 hours every other night until 100 hours have been given, and then, if necessary, another shorter course after four weeks. X-rays are used in a method like that of Krönig and Gauss, except that fewer and larger ports of entry are employed. Three millimetres of aluminium are used as a filter. At the time of writing, his experiments with the Coolidge tube were not far enough advanced for publication.

Arcelin¹⁰ has an important paper on the difficult and intangible subject of late X-ray effects, of which he has collected eight cases, in two of which, however, the only effect after the conclusion of all X-ray treatment seems to have been the development of telangiectases. He does not distinguish between cases treated by filtered and unfiltered rays, but a study of his cases bears out Spéder's contention that late reactions only occur when filtered rays have been used, *unless the unfiltered dose has been sufficient to produce a burn*. Arcelin points out that these late effects are more likely to develop when large areas have been treated. He shows that when a patient has been treated with X-rays, and received a large dose, a subsequent treatment, after an interval of a year or more, with similar doses, may sometimes provoke a dermatitis, whereas none had previously developed. He follows Nogier and Regaud in the belief that the use of thicker

and character of the lesions. The radiograms reproduced are good, and are evidently taken in a very short time, probably less than a quarter second.

ELECTROTHERAPY.

Bergonié¹⁴ found it possible to use a strong electro-magnet to bring a magnetic foreign body, be it a German bullet, with ferro-nickel sheath, or a fragment of a shell, gradually to the surface, or, rather, under the skin, for it to be extracted by surgical measures. Later, he found that if an alternating current magnet were approached to a magnetic foreign body in the tissues, a vibration of the fragment occurred, which served to localize it, and to guide the surgeon to it. A large magnet and considerable energy (3 kilowatts, at least) must be used, and turned off immediately it is not required, to diminish heating. Steel instruments must not be used while the current is on, for they vibrate too. The point of maximum vibration, determined by palpation, is that part of the surface which is nearest to the foreign body.

Needless to say, the method does not in any way replace radiography, particularly as pieces of lead, such as shrapnel bullets, do not vibrate, but it may dispense with the need for an accurate X-ray localization.

Dennis¹⁵ has had a great measure of success with ionic medication in several complaints, for which its use is not well enough known. A couple of cases of carbuncle responded to the treatment with zinc ions with remarkable readiness, even though, in one case, the size of the carbuncle was more than 8 by 6 inches. Boils, too, clear up readily, a zinc needle being inserted and the ions being introduced by making this the positive pole, the current being reversed for a few moments in order to be able easily to extract the needle. Chronic ulcers of the leg heal readily. Paronychia, lasting some months, will clear up with a single treatment. Salicylic ions have given good results in the treatment of neuritis, chronic rheumatic arthritis and peri-arthritis, fibromyositis, sprains, etc. One case of acute gout, treated with lithium ions, obtained immediate relief, and the swelling rapidly subsided.

Hugo¹⁶ describes a new electrode for post-nasal ionization. It consists of a T piece of metal, covered with a pad of lint,

at the same time, thus giving a better idea of the relations of the parts.

Hirsch's article,¹² "the Roentgen Ray examination of fractures," disposes of several of the criticisms levelled by some clinicians against the method. He enumerates several sources of error, and shrewdly mentions "looking and not seeing"; he advises that the plate be studied with as much care as the surgeon exhibits to the patient. His remarks on callus are not confirmed by my own observations. For instance, he says: "In children the hazy shadow of a mass enveloping the fracture-ends may be seen at the end of the first week." Now, I carefully examined a number of children for the first appearance of callus some years ago, and the earliest date on which there was any sign of it was the 11th day, and, generally, there was no evidence of it until the 12th or 13th days. Further, the first appearance of callus was in the periosteum of the fragments at some distance from the fracture, and not between the bones, as Hirsch states, and ossification appears to spread towards the fracture, and not away from it.

Voulers and Desplats¹³ have investigated the appearance in pulmonary tuberculosis obtained by rapid radiography, in comparison to the clinical signs. Radioscopy is always used as well, and is of great utility, but this paper is purposely confined to the author's observations on radiograms, taken in a very short time, the only ones which reproduce on the plate the appearances seen on the screen. A radiogram must be regarded merely as physical signs, just as percussion and auscultation, and not as any pathognomonic sign. Used in this way, it may be of the utmost value. Four classes of cases are recognized.

- I. When the radiographic signs correspond with the other physical signs.
- II. When radiography shows more than the other physical signs.
- III. When radiography reveals lesions, but there are no physical signs.
- IV. The rare cases in which physical signs show more than radiography.

They conclude that it is a most valuable method when used in this way, and is especially useful to map out the extent

and character of the lesions. The radiograms reproduced are good, and are evidently taken in a very short time, probably less than a quarter second.

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soaked in the solution required. This is attached to a wire, which is insulated by a rubber tube passed over it. A stout silk thread is passed from the nose to the mouth, by means of a Belloc's sound; this is then used to draw the insulated copper wire attached to the electrode through the nose, the pad being introduced from the mouth and pushed up behind the soft palate. He has found this method useful in deafness resulting from chronic post-nasal catarrh. For stenosis of the Eustachian tube a zinc electrode is introduced through a Eustachian catheter. Successful results in other diseases, such as pyorrhœa, rectal fistula, etc., are quoted.

Electrotherapy and radiotherapy are being largely used in the treatment of wounds, and it is noteworthy that, in France especially, large institutions have sprung up for this purpose.

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- ¹ *New York Medical Journal*, Vol. CI., No. 13, March 27, 1915.
- ² *Medical Record*, Vol. LXXXVI., No. 2, July 11, 1914.
- ³ *Dublin Journal of Medical Science*, 3rd Series, No. 519, March, 1915.
- ⁴ *Report of the Work of the Radium Institute*, January 1, 1914, to December 31, 1914.
- ⁵ *New York Medical Journal*, Vol. C., No. 1, July 4, 1914.
- ⁶ *Canadian Practitioner and Review*, September, 1914.
- ⁷ *Ibid.*, Vol. XXXIX., No. 6.
- ⁸ *Interstate Medical Journal*, Vol. XXII., No. 3 March, 1915.
- ⁹ *Medical Record*, Vol. LXXXVI., No. 15, October 10, 1914.
- ¹⁰ *Journal de Radiologie et d'Électrologie*, Vol. I., No. 10, August, 1915.
- ¹¹ *Bristol Medico-Chir. Journal*, Vol. XXXII., No. 125, September, 1914.
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- ¹³ *Journal de Radiologie et d'Électrologie*, Vol. I., No. 10, August, 1915.
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- ¹⁶ *South African Medical Record*, Vol. XII., No. 13, July 11, 1914.



RECENT WORK ON DISEASES OF THE NERVOUS SYSTEM.

By H. CAMPBELL THOMSON, M.D., F.R.C.P.

Physician to the Department for Diseases of the Nervous System, Middlesex Hospital; Physician to the Hospital for Epilepsy and Paralysis, Maida Vale.

GUNSHOT WOUNDS OF THE PERIPHERAL NERVES.

IN a recent practical paper on this subject, Dr. Wilfred Harris¹ remarks that the principal problems to be solved in such wounds are the diagnosis and accurate localization of the injured nerves; the degree and type of injury; the prognosis; and the decision as to the necessity for an operation to suture a partially or completely divided nerve or to free it from scar tissue.

With regard to hysterical symptoms, which may complicate those of organic origin, he points out that neither apparent muscular paralysis nor anæsthesia of a limb must be considered as being due to actual injury of a nerve without corroborative evidence. It is, for example, a very common experience to find cases, in which the shock of the injury has induced functional paralysis of the whole or part of a limb, in addition to the local muscular paralysis, due directly to any injured nerve. Hysterical manifestations, whether motor or sensory, do not follow the anatomical distribution of a peripheral nerve, and, further, in hysterical anæsthesia the skin is moist and sweaty, while in severe nerve injuries it is dry, cold, and scaly, with (in cases of hand affections) wasting of the finger pads.

As an example of organic and hysterical symptoms existing together, Dr. Harris cites the case of a patient who was shot through the forearm just above the wrist, and sustained a fracture of the radius. The wound healed normally, but when seen six weeks later there was loss of all voluntary movement of the hand and fingers, the latter being in a position of contracture resembling that of tetany. There

soaked in the solution required. This is attached to a wire, which is insulated by a rubber tube passed over it. A stout silk thread is passed from the nose to the mouth, by means of a Belloc's sound; this is then used to draw the insulated copper wire attached to the electrode through the nose, the pad being introduced from the mouth and pushed up behind the soft palate. He has found this method useful in deafness resulting from chronic post-nasal catarrh. For stenosis of the Eustachian tube a zinc electrode is introduced through a Eustachian catheter. Successful results in other diseases, such as pyorrhœa, rectal fistula, etc., are quoted.

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3. In estimating the severity of an injury to a mixed nerve, carefully taken charts of the sensory loss are more important than the presence of complete muscular paralysis with reaction of degeneration.

Dr. Harris further considers that the different stimuli used in testing (*e.g.*, hard or light pressure, pin-prick, scratch, camel-hair brush, or cotton-wool) are tests of different degrees of conductivity of the nerve rather than of different systems of fibres. Hard pressure, he finds, will still be perceived, except in total interruption of the nerve conductivity, such as may occur from actual division or in consequence of inclusion in a dense scar. Commencing recovery of sensation may in some cases be observed within a few days only of secondary suture of the nerve. Variations, however, in the sensibility must be allowed for, because this may vary, within narrow limits, from day to day or according to whether the limb is warm or cold.

ELECTRICAL TESTING OF MUSCLES.

The investigation of so many nerve injuries has further shown the need for revising our ideas concerning this method of diagnosis.

Dr. E. P. Cumberbatch recently read a paper on the subject before the Electro-Therapeutic Section of the Royal Society of Medicine,² in which he criticized the present methods of testing muscles electrically and the inferences commonly made therefrom. He considered that the ideas ordinarily held concerning the reaction of degeneration especially require revision. He mentioned that, in using electrical reactions to estimate the severity of a nerve lesion, the first difficulty lies in the absence of a method for representing accurately the strength of current used; in a number of cases, giving the reaction of degeneration, it had been found that the muscle responded on using a stronger Faradic current. In such a case, the reaction of degeneration was only partial, and, according to views generally held, the prognosis was more favourable. He mentioned as well that it is not a definite statement to say that the reaction of a particular muscle to the Faradic current is weak, for, on the one hand, the strength of the stimulus

was also total anæsthesia of the whole hand up to the wrist, which was dissipated by means of Faradism and suggestion, leaving behind a residual anæsthesia of distribution characteristic of median nerve paralysis.

The steps by which the diagnosis in this case was arrived at were as follow :—

1. The tetanoid position of the hand was suggestive of hysterical contracture.
2. The total anæsthesia of the whole hand, back, and front, was unexplainable, except on the supposition that the median, radial, and ulnar nerves had all been severely injured, which, from the position of the bullet wound, was not possible.
3. Normal reactions of the interossei to the Faradic current showed that the ulnar nerve was not injured.
4. The skin over the area of distribution of the median nerve was thin and sweaty, and the pulps of the thumb and index finger were wasted. The fact that the skin was sweaty in the distribution of the median nerve indicated either a partial lesion or commencing recovery, and sufficient time had not elapsed for the latter to have occurred. A well-marked though sluggish contraction to galvanism of the abductor and opponens pollicis, which had lost their irritability to Faradism, was also indicative of a partial lesion. Acting on these conclusions, the nerve was cut down upon and found to be involved in scar tissue.

Finally, in a summary of the subject, Dr. Harris lays stress on the following points :—

1. The importance of obtaining an accurate history of the details of the wound and of the immediate effects produced.
2. The necessity of a careful and methodical examination of paralysis, both motor and sensory, to determine whether it corresponds to the anatomical distribution of one or more nerves or of a portion of a plexus, or whether, on the other hand, it resembles the phenomena produced in hysteria.

inclining distinctly to the opinion that any apparent difference depends upon the reactions of the tissues attacked rather than on variation of the attacking organism.

Thus, in an article on "Parasyphilis and the Nervous System," published jointly by McIntosh, Fildes, Head and Fearnside,³ the following passage occurs:—

"The difference between the consequences of the tertiary and of the parasyphilitic process lies in the nature of the tissues participating in the reaction. In the one case, the connective tissue is capable of repair, and the focus is readily reached by the remedial agents. In the case of 'parasyphilis,' reaction of the essential nerve elements leads to their death, and antisyphilitic remedies cannot readily reach the spirochæte."

The subject has recently been considered by W. G. Spiller from the standpoint of the

PATHOLOGY OF TABETIC OCULAR PALSY.⁴

This author mentions that, while we recognize tabes, tabo-paresis, primary optic atrophy, and cerebro-spinal syphilis as distinct clinical forms caused by the spirochæta pallida, it is doubtful if, in many cases, such sharp distinctions can invariably be maintained, and whether tabes and paresis are truly parasyphilitic diseases, or should be regarded as belonging more closely to syphilitic affections proper. He alludes to the difficulty, which may occur clinically, in determining whether a certain case should be considered as one of tabes or spinal syphilis, and similarly to the doubt that may exist between paresis and cerebral syphilis. He also mentions that cases have been described, in which cerebral syphilis has been thought to be associated in the same person with paresis. Tabetic ocular palsies are usually considered to be of nuclear origin, while those of brain syphilis are thought to arise from nerve degeneration. Spiller doubts the truth of this belief, and thinks it more probable that ophthalmoplegias of both tabes and brain syphilis are due to syphilitic meningitis in the locality of the cerebral peduncles. In this area, the ocular nerves are near one another, and on this supposition, one can understand how all the ocular

is not known, and, on the other hand, the response of a muscle varies considerably under different conditions, *e.g.*, of temperature.

With regard to the indications of the severity of the lesions, if a muscle gives a reaction of degeneration it naturally shows the injury to be more severe than if the reaction is normal, but, beyond that conclusion, nothing further should be assumed. For instance, a slight injury to a nerve might recover quickly, and yet, until recovery had taken place, it might show reaction of degeneration, and there were cases in which reaction of degeneration could even be elicited in muscles in which the voluntary power was good. Dr. Cumberbatch believes that the best method of arriving at the condition of a nerve by electrical methods is to test the nerve itself above the point of injury, for the contraction of a muscle from stimulation of its nerve trunk above the point of injury is evidence of the presence of conducting fibres sufficient to cause the muscle to contract.

These two papers by Dr. Wilfred Harris and Dr. Cumberbatch, taken together, are interesting as showing the care that is needed before any conclusion about the condition of an injured nerve can be arrived at, as well as the clinical importance which the sensory changes have more recently assumed in proportion to the loss of power and electrical reactions, which, in past times, were considered the more reliable signs.

ON THE IDENTITY OF PARASYPHILITIC AND SYPHILITIC DISEASE.

Since the presence of the spirochæte in the nervous system has been demonstrated satisfactorily in cases of tabes and general paralysis, evidence has gradually accumulated to show the close relationship that exists between the so-called "parasyphilis" and the syphilitic diseases proper. The term "parasyphilis" is, in fact, in process of disappearance, being replaced by that of parenchymatous syphilis to indicate that the essential elements of the nervous system are attacked, as distinguished from interstitial syphilis, which is the term used to indicate that the disease is primarily situated in the vessels and connective tissue. There is still some doubt whether the pathological processes in the two conditions are alike, but many writers seem to be

inclining distinctly to the opinion that any apparent difference depends upon the reactions of the tissues attacked rather than on variation of the attacking organism.

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nerves may come to be affected in tabes or cerebral syphilis without the implication of other cranial nerves, while, according to the hypothesis of nuclear degeneration, it would be difficult to explain such a selective distribution of the palsy.

Spiller believes, that if careful microscopical examination is made of the region of origin of the ocular nerves in cases of tabes with ophthalmoplegia, it will be found impossible to regard tabetic palsies of ocular muscles as primarily nuclear in origin, and that some evidence of meningeal infiltration will be found to account for their presence.

SENILE PARAPLEGIA

is the subject of an article by Allen Starr,⁵ in which he claims that the term includes a number of different pathological conditions. Old age being a relative term dependent on the inherent vitality, power of endurance, and vascular condition of the individual, the term "senility" is an elastic one, which cannot be limited to any particular date of a person's existence. The clinical pictures of different cases are similar in their early symptoms. The individual becomes gradually more and more feeble, and notices an increasing disability in walking, going upstairs, or standing for any length of time, which gradually increases until he becomes bedridden. In some instances, ataxy is a more prominent feature than weakness, while, in others, pain is an important symptom. Atrophy of muscles, greater than that usually attending old age, may occur, and be accompanied by loss of mechanical irritability to percussion and diminished tendon reflexes.

The limbs, as a rule, are flabby, cold, and blue, showing a sluggish circulation and disturbance of vasomotor function. Occasionally, in the later stages, there may be some loss of sphincter control, which, in men, must be distinguished from disturbance due to prostate trouble, and there is too apt to be pain in the back and loins, together with general mental depression.

Starr considers that it is possible to distinguish certain groups, which he classifies as follows:—

- i. Cases in which the primary cause of the weakness lies in the muscles, which may be likened to those

of muscular dystrophy.

- Cases in which there is an active degenerative neuritis with pain, burning and tingling in the limbs, and tenderness over the course of the nerves. The anterior crural nerves are more frequently affected than the sciatics.

3. Cases in which the trouble lies in the spinal cord.

In these last, progress is more rapid, and incoordination and early involvement of the sphincters frequently occur, while, in the later stages, there may be trophic changes in the skin. Starr considers that, in these cases, the symptoms suggest the presence of venous congestion of the lower part of the cord rather than that of an active myelitis.

The prognosis of all the classes is unfavourable, though temporary improvements may occur.

• With regard to treatment, Starr advises—

- a. In the muscular cases, a stimulating diet with meat, fatty foods, and plenty of water, but with a diminution of salt. Mild stimulation with alcohol and small doses of strychnine he considers likely to be useful. Warm baths (temp. 100°), with mild massage followed by rest in bed and warmth, are also likely to be beneficial.
- b. In those cases in which there is manifest neuritis, baths and all manipulation of the limbs have to be avoided on account of tenderness, and, if local applications are given, they should take the form of soothing lotions applied lightly on soft linen cloths.
- c. In the spinal cases, hot and cold douches to the back, massage to the back and limbs, and dry cupping of the spine have been found useful. It is possible too that tonics containing digitalis and strychnine may be of some service in this class of case.

THE FUNCTIONS OF THE PINEAL GLAND

have recently been studied by Carey Pratt McCord.⁶ He reviews the current ideas, by which the pineal gland is thought to secrete a substance which inhibits growth of body, and restrains mental and sexual development from exceeding

the rate looked on as normal for pre-adult life. He alludes to the fact that the groundwork on which this theory has been built is not very stable, and mentions that it is noteworthy that the pineal syndrome seems to have occurred only in those cases of pineal tumours which have led to obstructive hydrocephalus, and thus, of necessity, to secondary hypophysial disturbances. Further, the available histories of tumours frequently do not permit the cases to be reconsidered in the light of recent knowledge concerning the interrelation of the different ductless glands.

After alluding to the difficulties which arise in experimental extirpation of the pineal gland, the author gives an account of a series of experiments he carried out on animals by administering the gland substance in the form of food. In his general summary of results, McCord considers he has obtained evidence of the precocity of development, usually attributed to pineal deficiency, as the result of supplying an increased amount of pineal substance by feeding with or injecting pineal preparations. Such administration of pineal substance led to a more rapid growth of body than normal, and determined an early sexual maturity. The excess in rate of growth was most pronounced in young animals fed with pineal tissue obtained from young animals. No tendency to gigantism has followed pineal administration, and, after maximum size had been attained, pineal administration appeared to be ineffective. Both males and females respond to the influence of the gland in rate of growth, but the response was more definitely manifested in males.

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SOME PRESCRIPTIONS AND THEIR USES.

By A. GRAHAM-STEWART, M.B., CH.B.

Physician to Orphan Working School, Margate; to Lawn House, Convent of the Daughters of the Cross, Margate; Physician, Auxiliary Military Hospital, Margate, etc.

I HAVE found the following prescriptions of much service. As I have learned a good deal from studying the prescriptions of others, I publish them in the hope that they may be useful; that they may possibly fill some small gap or, perchance, suit some case in which other formulæ have not come up to expectation. Probably some of them may hold incompatibilities on which the keen pharmacist might lay hold. I can say, however, that there are no dangerous incompatibilities, and, further, that they are not experimental prescriptions, but old and tried friends. If some of them meet with the condemnation that they are too full or too elaborate, I may point out that not only we, but the public as well, judge a good deal by results. It is my humble opinion that I have secured better results by far from these prescriptions than from simpler and more inelegant preparations.

DYSPEPSIA.

A tonic; hyperchlorhydria—before meals, followed by an alkali one and a half hours after; achlorhydria—after meals; furred tongue; especially in the dyspepsia of childhood associated with constipation and anorexia.

R	Tr. Capsici	-	-	-	-	℥ ss-i.
	Tr. Nucis Vomicae (1914)	-	-	-	-	℥ x-xx.
	Liq. Arsenici Hydrochlor.	-	-	-	-	℥ ss-i.
	Acid. Nitrohydrochlor. Dil.	-	-	-	-	℥ x-xx.
	Liq. Helalin. et Pepsin. Co. (Oppenheimer)					℥i.
	Syr. Aurantii	-	-	-	-	℥i.
	Aq. destillat.	-	-	-	ad	℥i.
	Misce.					Ft. mist.

Sig.: ℥i. ex aq. t. d. post (vel ante) cibum.

This mixture, though bitter, is not inelegant, and, with

the capsicum omitted, is readily taken by children, and is exceedingly efficacious in the ordinary dyspepsia of childhood. If hepatic function is sluggish, in place of the H. & B. Liq. Euonymin et Pepsin Co. may be substituted.

ASTHMA.

In an ordinary case of bronchial asthma (as distinguished from cardiac, renal, or cardio-vascular asthma), the following, taken between the attacks, will often ward them off or greatly lessen their intensity. In those cases developing the disease mildly after youth is past, it will sometimes almost effect a cure.

R	Liq. Trinitrini	-	-	-	-	℥ i-ij.
	Sodii Iodidi	-	-	-	-	grs. ij-x.
	Sodii Bromidi	-	-	-	-	grs. v-xv.
	Ext. Euphorbiæ Piluliferæ Liq.	-	-	-	-	℥ iij-v.
	Tr. Lobeliæ Æther.	-	-	-	-	℥ v-x.
	Spt. Chloroform.	-	-	-	-	℥ x.
	Tr. Cardamomi Co.	-	-	-	-	℥ x.
	Syr. Aurantii Floris	-	-	-	-	℥ xx.
	Aq. destillat.	-	-	-	ad	℥ ss.
	Misce. Ft. mist.					

Sig.: Ter in die post cibos.

It is better that the patient should recline for half an hour after taking this prescription on account of the possible effect of the glonoin.

COUGH.

Especially the troublesome cough of phthisis pulmonalis, where there is no expectoration to be released. Efficacious though a dose of a simple opiate may be, I have found the following combination to give more relief than simpler mixtures; in combination, the amount of the true opiate may be kept very small. The mixture is pleasant to take, and there is no depressant action on the heart, nor is it followed by nausea or obstinate constipation—an important feature.

R	Nepenthe	-	-	-	-	℥ v-x.
	Terpin. Hydrat.	-	-	-	-	grs. iiss.
	Acid. Hydrocyan. Dil.	-	-	-	-	℥ ij
	Tr. Belladonnae	-	-	-	-	℥ v.
	Tr. Hyoscyami	-	-	-	-	℥ xv.
	Spt. Chloroform.	-	-	-	-	℥ x.
	Tr. Cardamomi Co.	-	-	-	-	℥ xx.
	Syr. Pruni Virgin.	-	-	-	-	℥ xx.

Syr. Tolutani - - - ℥ xx.

Aq. destillat. - - - ad 3ss.

Misce. Ft. mist.

if : A tablespoonful in water when the cough is troublesome.
half dose may be repeated in two or three hours.

he spirit of chloroform and the tincture of cardamoms
olve the terpin. If night sweats are present, more bella-
nna may be added. In place of the nepenthe, heroin
hydrochloride, gr. $\frac{1}{4}$ th to gr. $\frac{1}{2}$ th may be substituted.

A NUTRITIVE TONIC.

As a nutritive tonic—in thin, weakly, anæmic or strumous
children ; in wasting diseases, especially tuberculous states ;
as an aid to regular evacuation of the bowels ; in amenor-
rhœa and chlorosis, and in any vitiated blood state ; in
rickets and in all states of malnutrition :—

R Liq. Arsenicalis - - - ℥ iij.

Ferri et Ammon. Citrat. - - - grs. v.

"Casarea Evacuant" (P., D., & Co.) - ℥ i-xx.

Syr. Hypophosph. Co. - - - ℥ xxx.

Syr. Glycerophosph. Co. - - - ℥ xxx.

Hordine (Oppenheimer) - - - ad 3ss., or 3i.

Misce. Ft. mist.

Sig. : In water, three times daily after food.

In place of the iron and ammonium citrate, the solution
of iron peptonate and manganese, with or without arsenic
(Parke, Davis, & Co.), may with advantage be substituted ;
this addition makes thorough shaking of the bottle necessary

The action is greatly enhanced by giving at the same
time some intestinal disinfectant (in separate form, of course),
e.g., a palatinoid or two of guaiacol carbonate (5 grains in
each) ; a 5-minim capsule of creosote ; 5 grains of naphthalene
tetrachloride in a cachet ; 5 grains of ichthyol in a capsule ;
or, best of all, a 10-minim globule of proposote.

DYSPEPSIA.

In simple dyspepsia, especially in the aged, where the
powers of digestion are feeble ; in flatulence arising from
simple indigestion ; where superalimentation is necessary ;
in almost any dyspepsia when the digestive secretions are
deficient.

R Strychninæ Sulphatis - - - gr. $\frac{1}{10}$.

Menthol. - - - gr. $\frac{1}{4}$.

Pulv. Carbo. Ligni - - - grs. iij.

"Taka Diastase"	-	-	-	-	grs. i
"Lactopeptine"	-	-	-	-	grs. vj
Misce. Ft. cachet.					

Sig.: One cachet three times daily after food.

A GENERAL CARDIAC TONIC.

As a general cardiac tonic, especially where there is of tone; in cardiac neurosis; in mild dilatation due to loss of muscular tone; in pseudo-angina; and in cases in which there is cardiac irritability with moderate rise in blood-pressure; also in cardio-vascular spasm, and where digitalis is contra-indicated or badly borne.

R Strychninæ Sulphat.	-	-	-	gr. $\frac{1}{60}$ - $\frac{1}{30}$.
Sparteïn. Sulphat.	-	-	-	gr. ss-ij.
Morphinæ Sulphat.	-	-	-	gr. $\frac{1}{24}$.
Nitroglycerin.	-	-	-	gr. $\frac{1}{200}$ - $\frac{1}{100}$.
Calcii Glycerophosph.	-	-	-	gr. i.
Extract. Valerian.	-	-	-	gr. i.
Camphor. Monobromat.	-	-	-	gr. i.
Misce. Ft. pil.				

Sig.: One pill three times daily after food.

Where pain and restlessness are absent, the morphia ought to be omitted; in no case should the patient know he is taking this drug.

A GENERAL TONIC.

As a general tonic; where there is loss of muscular tone and disinclination for exertion; where the system is below par generally; in convalescence from any lowering illness. Not to be given in cases in which there is restlessness, inability to concentrate the mind, a tendency to sleeplessness, and depression. Unfortunately, the tendency is to prescribe similar preparations in these cases, which are really states of nervous irritability and nervous exhaustion, and are relieved by a course of bromides, but accentuated by such preparations as this. In states of nervous tension strychnine and similarly acting drugs are powerfully contra-indicated.

R Phosphori	-	-	-	gr. $\frac{1}{18}$.
Strychninæ Sulphat.	-	-	-	gr. $\frac{1}{60}$ - $\frac{1}{30}$.
Ferri Arsenatis	-	-	-	gr. $\frac{1}{12}$.
Quininæ Sulphat.	-	-	-	gr. ss.
Ferri Redacti	-	-	-	gr. i.
Ext. Damianæ	-	-	-	grs. ij.
Ol. Res. Capsici	-	-	-	gr. $\frac{1}{12}$.
Misce. Ft. pil. (argent.).				

Sig.: One pill three times daily after food.

CONSTIPATION.

the
 Constipation; as an hepatic and intestinal stimulant;
 - inner pill; where the digestion is sluggish and the
 anal tract lacks tone; in those who live well, and
 those who overeat. Although this formula may appear
 necessarily full and complicated, I have found that the
 results obtained from it fully justify the extra trouble given
 to physician and chemist.

R Aloini.
 Iridin.
 Euonymin.
 Res. Podophyllin.
 Ext. Nucis Vomicae.
 Ext. Belladonnae.
 Ext. Cascaræ Sagrad.
 Ol. Res. Capsici.
 Phenolphthalein: aa gr. $\frac{1}{12}$, $\frac{1}{8}$, $\frac{1}{6}$, or $\frac{1}{4}$.
 Misce. Ft. pil.

Sig.: One or more, at night, when required (depending on the strength).

An average pill, for fairly mild cases, would contain $\frac{1}{16}$ th of a grain of each of the above ingredients. Leptandrin, juglandin, sanguinariin, or Hydrarg. subchlor. may be substituted for any of the above drugs. Although apparently of the "shot gun" order, a more than cursory examination of the formula will show that it is built up on a scientific basis; more important than which is, perhaps, the fact that the results obtained from it have justified the trouble. The various components may be ordered in any strength desired; it is the general combination which, I believe, gives the good results. Where all the quantities are small, there is less chance of any drug disagreeing, and so giving the patient the idea (erroneous or otherwise) of having been asked to use an unskilful prescription.

BLADDER SEDATIVE.

As a bladder sedative in the milder cases; where there is vesical spasm, frequency of micturition, or pain; at the early onset of simple cystitis; in slight bladder chill giving rise to abortive cystitis; in urinary irritation, and in the irritation caused by hyperacidity; in prostatic irritation, and in most forms of bladder irritability, except where there is

strong alkaline decomposition.

R Potass. Citrat.	-	-	-	grs.
Sodii Bromidi	-	-	-	grs. 2
Tr. Belladonnæ	-	-	-	℥ v-xx
Tr. Hyoscyami	-	-	-	℥ xx-xi
Elixir Uritone Co (P., D., & Co.)	-	-	-	3i-3ii.
Infus. Buchu (recentis)	-	-	-	ad 3i.
Misce. Ft. mist.				

Sig.: Two tablespoonsful in water every four or six hours.

A GARGLE.

As a gargle in tonsillitis, follicular tonsillitis, or septic throats; in certain scarlatinal throats, and in certain cases of diphtheria. Wherever an antiseptic gargle is indicated, it makes an elegant and efficacious preparation. It may also be used as a mouth-wash, and for washing out the mouth and rinsing the teeth in pyorrhœa, stomatitis, etc.

R Liq. Hydrogenii Peroxidi cum Acetanilide				
(P., D., & Co.) (vols. 20)	-	-	-	3ii.
Glycothymoline.				
Listerine	-	-	-	āā 3i.
Sat. sol. Acid. Boric.	-	-	-	ad 3viii.
Misce. Ft. gargarisma.				

Sig.: To be used with an equal quantity of boiling water every two hours.

CONTINUOUS ANTISEPTIC INHALATION.

For the continuous antiseptic inhalation treatment of phthisis pulmonalis, bronchiectasis, gangrene of the lung, etc. The addition of the terebene greatly adds to the pleasantness of the inhalation.

R Creosoti.				
Acid. Carbolic.				
Tr. Iodi	-	-	-	āā 3ii.
Spt. Chloroform.				
Spt. Ætheris	-	-	-	āā 3i.
Tereben.	-	-	-	ad 3iss.
Misce. Ft. guttæ.				

Sig.: 15-20 drops to be placed on the mask every two hours.

The most suitable mask for the purpose is the "Lombard" oro-nasal inhaler, which is made by Allen and Hanburys.

Where there is dyspnœa, orthopnœa, or difficulty in getting the breath, I have found the following prescription invaluable. The effect is rapid, and the relief obtained is often surprising. It is very useful in cases of chronic

ore especially the later stages of granular kidney) ;
lood-pressure states ; in cardio-vascular degenera-
the dyspnœic phases of uræmia, and in the dyspnœa
geal tuberculosis, etc.

R	Spt. Ætheris	-	-	-	℥ xx.
	Spt. Ætheris Nitrosi	-	-	-	℥ xxv.
	Spt. Chloroform	-	-	-	℥ xv.
	Spt. Ammon. Aromat.	-	-	-	℥ xxx.
	Aq. destillat.	-	-	-	ad ʒi.

Misce. Ft. haustus.

Sig: To be given in an equal quantity of water when the breathing is distressed.

On account of its pungency, patients should be warned not to gulp this draught, but to drink it carefully.

DIABETIC COMA OR ACIDOSIS.

When diabetic coma or acidosis is threatening, the following combination will often completely clear off the dangerous threatening signs. Cases on the very border of actual coma may sometimes be brought into a state of comparative safety. It is a modification of a prescription suggested by Dr. Langdon Brown in his "Physiological Principles in Treatment."

The heralding signs indicating the use of this mixture are, when they occur in the subject of diabetes or glycosuria :—

1. Obstinate and sudden constipation.
2. Feelings of dizziness, cloudiness of the brain, inability to think quickly and clearly, and difficulty in concentrating the mind.
3. Loss of appetite, with furred tongue.
4. The sweet smell of acetone on the breath.
5. The appearance of acetone bodies in the urine.
6. Feelings of general lassitude and disinclination for exertion.
7. Acceleration of the respiratory rate, indicative of the advent of air hunger.
8. Nausea or vomiting.

For 48 hours, the diet should consist of copious draughts of milk (skimmed or citrated) and Contrexéville water. A sharp saline purge should first be given.

After the attack is over, this preparation, or half doses of it, should be taken during the first and third weeks of every month—two or three times daily. The magnesium and

strong alkaline decomposition.

R Potass. Citrat.	-	-	-	-	grs.	℥i.
Sodii Bromidi	-	-	-	-	grs.	℥i.
Tr. Belladonnæ	-	-	-	-	℥	v-x.
Tr. Hyoscyami	-	-	-	-	℥	xx-xi.
Elixir Uritone Co (P., D., & Co.)	-	-	-	-	℥i-℥ii.	
Infus. Buchu (recentis)	-	-	-	-	ad	℥i.
Misce. Ft. mist.						

Sig.: Two tablepoonsful in water every four or six hours.

A GARGLE.

As a gargle in tonsillitis, follicular tonsillitis, or sept throats; in certain scarlatinal throats, and in certain case of diphtheria. Wherever an antiseptic gargle is indicated it makes an elegant and efficacious preparation. It may also be used as a mouth-wash, and for washing out the mouth and rinsing the teeth in pyorrhœa, stomatitis, etc.

R Liq. Hydrogenii Peroxidi cum Acetanilide						
(P., D., & Co.) (vols. 20)	-	-	-	-	℥ii.	
Glycothymoline.						
Listerine	-	-	-	-	āā	℥i.
Sat. sol. Acid. Boric.	-	-	-	-	ad	℥viii.
Misce. Ft. gargarisma.						

Sig.: To be used with an equal quantity of boiling water every two hours.

CONTINUOUS ANTISEPTIC INHALATION.

For the continuous antiseptic inhalation treatment of phthisis pulmonalis, bronchiectasis, gangrene of the lung etc. The addition of the terebene greatly adds to the pleasantness of the inhalation.

R Creosoti.						
Acid. Carbolic.						
Tr. Iodi	-	-	-	-	āā	℥ii.
Spt. Chloroform.						
Spt. Ætheris	-	-	-	-	āā	℥i.
Tereben.	-	-	-	-	ad	℥iss.
Misce. Ft. guttæ.						

Sig.: 15-20 drops to be placed on the mask every two hours.

The most suitable mask for the purpose is the "Lombard" oro-nasal inhaler, which is made by Allen and Hanburys.

Where there is dyspnœa, orthopnœa, or difficulty in getting the breath, I have found the following prescription invaluable. The effect is rapid, and the relief obtained is often surprising. It is very useful in cases of chronic

Acid. Aceto-Salicyl.	-	-	-	grs. v-xv.
Quininæ Sulphatis	-	-	-	gr. i-ii.
Caffein. Citratis	-	-	-	grs. iii.
Misce. Ft. cachet.				
∴ One every four or six hours.				

INSOMNIA.

In insomnia, especially if associated with mild excitement or pain; also in mild alcoholic states. It has a very soothing effect. It is almost superfluous to say that on no account should this prescription be given to a patient to have made up at pleasure; preferably it should be used when the patient is under the care of a nurse, or in a nursing home. The ingredients ought not to be made known to the patient.

R Nepenthe	-	-	-	℥ v-xv.
Sodii Bromidi	-	-	-	grs. x-xxx.
Chloral. Hydratis	-	-	-	grs. v-x.
Tr. Hyoscyami	-	-	-	℥ xx-xxx.
Spt. Chloroform	-	-	-	℥ x.
Syr. Papaveris	-	-	-	℥ xxx.
Syr. Tolutani	-	-	-	℥ xxx.
Aq. destillat.	-	-	-	ad ʒii.

Misce. Ft. haustus.

Sig.: To be given after retiring.

HYPERCHLORHYDRIA.

In hyperchlorhydria, when pain comes on two hours or more after food, or at about two a.m.; to be taken one and a half hours after food; where there is gastric irritability, combined with flatulence and pain soon after eating—to be taken just before food; in gastric and duodenal ulcer, gastric neuroses, and subacute gastritis.

R Acid. Hydrocyan. Dil.	-	-	-	℥ iij.
Tr. Capsici	-	-	-	℥ ss.
Sodii Bicarbonatis	-	-	-	grs. xv.
Sod. Sulphocarbolatis	-	-	-	grs. x.
Sodii Bromidi	-	-	-	grs. v-xv.
Liq. Bismuthi et Ammon. Citratis	-	-	-	ʒi.
Tr. Cardamomi Co.	-	-	-	℥ xv.
Spt. Chloroform	-	-	-	℥ x.
Syr. Zingiberis	-	-	-	℥ xxx.
Aq. destillat.	-	-	-	ad ʒi.

Misce. Ft. mist.

Sig.: To be taken before or after meals, as directed.

The doses given in these prescriptions are, in all cases, those suitable for adults. Obviously, some of the prescriptions are not permissible in the case of children.

calcium are necessary in order to replace the dr ~~is~~
alkaline bases. When an attack is threatening, ~~the~~
should be washed out with copious saline enemata. ~~the~~

R Calcii Carbonatis.

Magnesii Carbonatis	-	-	ââ	grs. iv.
Potass. Citratis	-	-	-	grs. xxx.
Sodii Bicarbonatis	-	-	-	̄i.
Spt. Chloroform	-	-	-	℥ iij.
Pulv. Tragacanth. Co.	-	-	-	q.s.
Aq. Anethi	-	-	-	̄iv.
Aquam	-	-	-	ad ̄ii.

Misce. Ft. mist.

Sig.: To be taken every three hours for four or six doses, and then reduced, if necessary, according to circumstances.

HIGH BLOOD-PRESSURE.

In states of high blood-pressure, when the left ventricle is being strained by the pressure thrown upon it; where, as a result of this continuous strain, cardiac dilatation is taking place; where, owing to high pressure, there is shortness of breath, a tendency to cyanosis, giddiness, insomnia, and the general symptoms arising from an uncompensated cardiovascular system. A lacto-vegetarian diet should be enforced, with rest and sharp magnesium or sodium sulphate purges.

R Sodii Nitritis	-	-	-	gr. ss-ij, or more.
Sodii Iodidi	-	-	-	grs. v-x.
Ammonii Hippuratis	-	-	-	grs. viiiss.
Sodii Bromidi	-	-	-	grs. x.
Spt. Chloroform	-	-	-	℥ x.
Syr. Zingiberis	-	-	-	℥ xxx.
Aq. destillat.	-	-	-	ad ̄i.

Misce. Ft. mist.

Sig.: To be taken, freely diluted with water, three times daily, immediately after food.

Digitalis, too, may be necessary; if there are symptoms clearly calling for the exhibition of this drug, there is absolutely no danger in employing it, however high the blood-pressure may be.

I have found the following cachet of much service in influenza, follicular tonsillitis, and in similar states associated with headache and severe aching in the back and legs. It may be given with safety, when there is occasion to guard against the production of cardiac depression:—

R Pyramidon	-	-	-	grs. iv.
Strychninæ Sulphatis	-	-	-	gr. ̄o.

be repeated, before the patient finally comes round
emory of all that has occurred.

epigastric region thus acts as a hysterogenic zone in
ases. I might mention that, with the exception of
e (a Sudanese), pressure in the ovarian region did not
or stop an hysterical fit.

The causes of this epigastric anæsthesia may be—

(1) The idea is still present in the public mind that the
heart is the seat of the emotions, grief, anger, love, hate,
etc., and his conception of the anatomy of the heart is that
it lies in the epigastrium. Diseases of the heart are still
supposed to account for all mysterious ills, and once the
complaint of pain is made in this region, then, partly from
auto-suggestion and partly from the suggestive way of exami-
nation, the area becomes anæsthetic. The following case
points to this conclusion.

A girl, 14 years old, came complaining of pain in the epigastrium
and a sense of obstruction in the throat. She was the subject of fits,
which, from the mother's description, must have been hysterical. The
girl could not say when her first fit started, but her mother said that
the girl was asleep in her master's house about nine months ago, when
a fire broke out, and she was rescued half asphyxiated. Shortly after-
wards she would complain of her heart being weak, putting her hand on
the epigastrium, and a few weeks later, when another fire broke out
near, she had her first fit. On examining her, the epigastric region was
anæsthetic, while on pressure a deep breath was taken, the hands
became tremulous, the legs rigid and extended, and after half-an-hour
of apparent sleep, she passed into tears, and came round unconscious
of the whole act.

(2) Pain in the epigastrium is the commonest complaint
in the out-patients (chiefly due to ankylostomiasis and gastric
disorders), and on mixing with others an hysteric can easily
catch the complaint. I remember a patient in whom obstruc-
tion in the throat was the chief complaint on her first visit,
but on the second occasion that was changed to severe
epigastric pain.

In patients who know the right position of their heart, I
have found, however, this epigastric anæsthesia present at the
first visit. This might be explained by supposing that at one
time (possibly childhood) the idea that the heart was in the
epigastrium had impressed the patient, and though with
further knowledge this had to be expelled from the conscious
mind, it remained in the subconscious, and when the "effect"

HYSTERICAL ANÆSTHESIA IN EGYPTIAN

By ABD-EL-AZIZ ISMAEL, M.R.C.P., D.P.H., D.T.M., ETC.

Resident Medical Officer, Kasr-el-Ainy Hospital, Cairo.

IN the last three years, I have seen no less than 60 cases of hysteria, chiefly as hospital out-patients. Considering the number of Sudanese living in Egypt, it is far more common in the Sudanese than the Egyptians. At least one-third of the cases are men, mostly Egyptian Fellahines.

Hysterical fits were often observed, and they chiefly belong to the hysteroid type, so named by Sir W. Gowers. The loss of consciousness is, however, slight, and the period in which the patient passes into tears, etc., is prolonged.

Of the hysterical stigmata, aphonia and anæsthesia are the commonest. The latter shows itself in the following forms in the order of frequency.

A.—Anæsthesia of the Epigastric Region.—This is present in the majority of cases, and I have now learnt to look for it whenever hysteria is suspected.

The patient on admission complains of a sense of obstruction in the throat, pain in the epigastrium, while a history of fits can generally be made out. On examination, it is found that the epigastric region is tender, sometimes very tender, and that the patient does not feel either touch or pain in a more or less quadrilateral area in the same region. Outside this, there is a zone about 1 cm. breadth where the patient answers "I am not certain that I feel," or "I feel slightly."

The anæsthesia can be shown by means of sterilized needles to involve the muscular tissues as well, and to have the character of hysterical anæsthesia, *i.e.*, the patient actually feels, which can be made out by telling her to say "Yes" when she feels, and "No" when she does not. No blood flows from the affected area when pricked. In some cases, examined for other maladies and not known to be hysterical before, pressure in the epigastric region unexpectedly is followed by several deep breaths, irregular contortions of the whole body, and often opisthotonos, to be followed by a variable period of calm unconsciousness, then weeping. The

